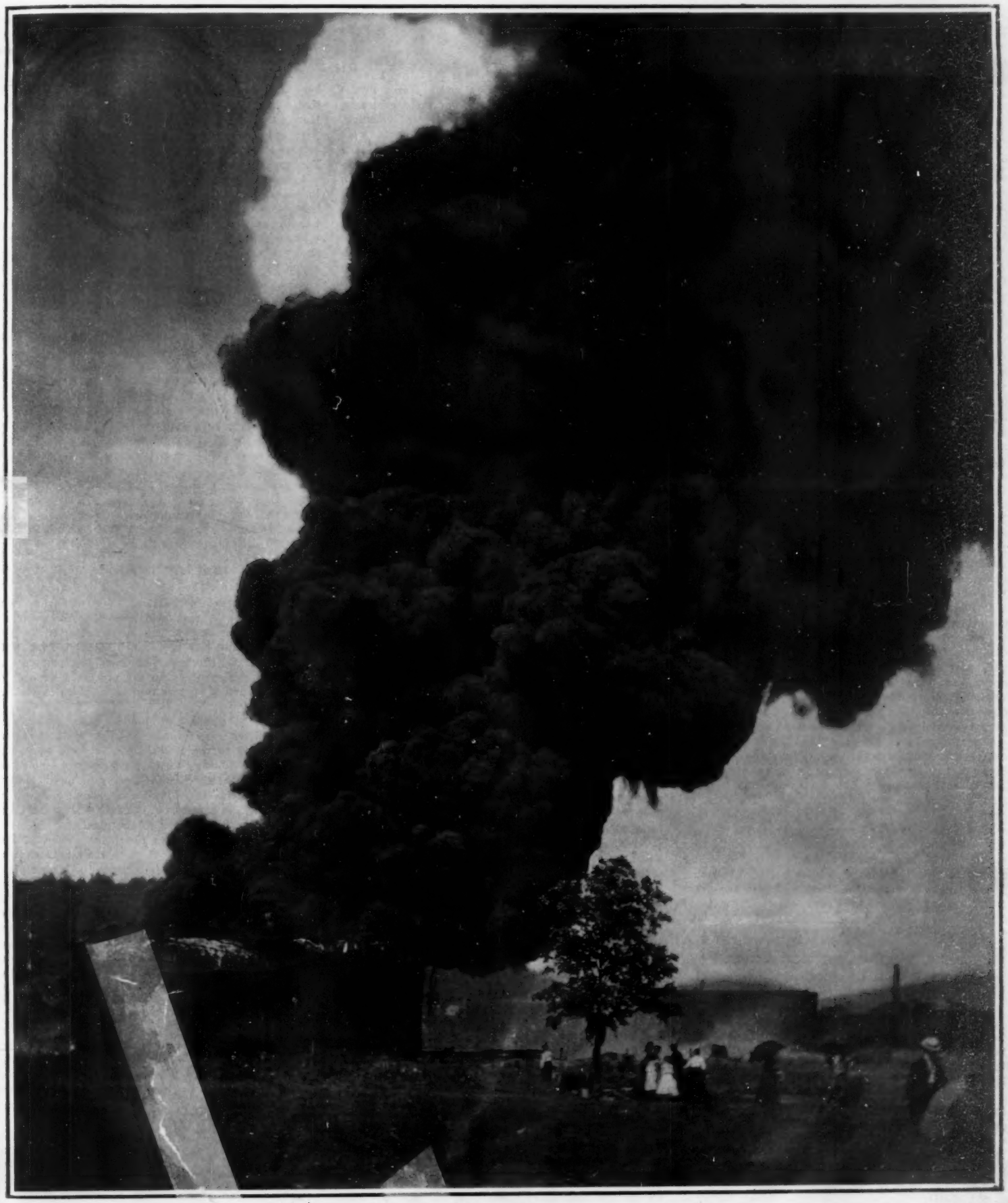
GENERAL LIBRARY,
UNIV. OF MICH.
DEC 10 1910

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1910, by Munn & Co., Inc.]

A POPULAR ILLUSTRATED WEEKLY OF THE WORLD'S PROGRESS

Vol. CIII.—No. 24. ESTABLISHED 1845. NEW YORK, DECEMBER 10, 1910. 10 CENTS A COPY. $3.00 A YEAR.



Thousands of dollars converted into smoke by a carelessly used match.

OIL LOSSES BY FIRE.—[See page 458.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., Inc., - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

CHARLES ALLEN MUNN, *President*
361 Broadway, New York.
FREDERICK CONVERSE BEACH, *Secy and Treas.*
361 Broadway, New York.

TERMS TO SUBSCRIBERS

Subscription one year..... $5.00
Postage prepaid in United States and possessions
Mexico, Cuba and Panama.
Postage to Foreign countries..... $1.20 per year extra.
Canadian postage..... .60 per year extra.

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (established 1845)..... $5.00 a year
Scientific American Supplement (established 1876)..... 5.00 "
American Homes and Gardens..... 3.00 "
The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., Inc., 361 Broadway, New York.

NEW YORK, SATURDAY, DECEMBER 10th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE FORTHCOMING GERMAN ANTARCTIC EXPEDITION.

IT is expected that the German Antarctic expedition under Lieut. Filchner will leave Germany in the early spring of 1911. Half the expenses of the expedition, estimated at 1,200,000 marks, have been subscribed, and the whaling-ship "Björn," 527 tons, has been purchased and renamed the "Deutschland." The crew will number 25, under ice-pilot Jörgensen, and the following, in addition to Filchner, will constitute the scientific staff: Dr. Barkow, of the Potsdam Meteorological Observatory, meteorologist and physicist; Dr. Brennecke, of the Deutsche Seewarte, oceanographer; Dr. Heim, geologist; Dr. Kohl, surgeon; Dr. Pryzbyllok, of the Potsdam Geodetic Observatory, astronomer and magnetician; Dr. Seelheim, geographer; Herr Neuberger, technologist; and another surgeon, not designated.

On its way southward the expedition will make a series of oceanographic observations in the Sargasso Sea and the Brazil Current, the intention being to explore a more westerly region of the Atlantic than has been investigated by previous expeditions. It is expected to enter the ice at South Georgia and proceed thence to the Sandwich Group, and then advance southward into Weddell Sea. A base station is to be established on the mainland south of Coats Land, from which the sled expeditions will start. It is expected that Captain Scott's English expedition will, in the meantime, have entered the Antarctic regions from the opposite side; i. e., from Ross Sea. In case the expeditions meet, as Filchner confidently expects they will, part of the German party will turn back and accompany Scott to Weddell Sea, and some of the English will retrace their steps, to guide Filchner onward to Ross Sea, each expedition thus making use of the provision-depots established by the other.

The proposed Scottish expedition, under Bruce, also expects to enter the polar regions by way of Weddell Sea, but has agreed to confine its operations to the portion east of longitude 20 deg., while the German party will remain west of that line. There is, of course, a possibility that all three expeditions may meet somewhere in the heart of the Antarctic.

The work at the base-station will include continuous meteorological and magnetic observations, including aerological investigations with kites and pilot-balloons. These will be of especial interest owing to the proximity, to the northward, of the meteorological stations maintained by the Argentine government in the South Orkneys and South Georgia.

RAPIDITY IN WARSHIP CONSTRUCTION.

WHEN the House of Representatives recently passed the bill for naval appropriations, they stipulated under the heading "Increase of the Navy" that of the two battleships authorized one or both might be built in a United States navy yard. Owing to the inclusion in the act of a clause calling for an eight-hour day for all workmen employed on these vessels, it looks as if the Navy Department might itself have to undertake the construction of both ships, for several of our shipyards—notably the Fore River Iron Works—announce that they could not afford to bid under such conditions. Only one shipbuilding company (the Newport News yard) submitted bids for a battleship. The four optional tenders sent in ranged from $5,760,000 to $5,830,000.

There are numerous reasons which might be advanced why it would be highly inexpedient to have both ships built by the government, but chief among these is the delay that would ensue from such a procedure. Unfortunately, the New York navy yard is the only one in the country which has the facilities for building large armored ships, and even at New York but one can be built at a time. The "Florida," at this date fairly well on the road toward completion, is in the water, so that her slip is available; but many valuable months would undoubtedly be lost before Capt. Baxter (the naval constructor in charge) could erect another slip and the accompanying plant for the second battleship. In these days of mad rivalry among the leading nations of the world for the mastery of the sea, the necessity for speedy construction is apparent; and with our conservative programme of but two new capital ships a year, we cannot afford to allow too much time to elapse between the letting of contracts and the delivery of the vessels to the government. Hence it is probable that the wise heads in Washington will find some means to accomplish the building of one of the two ships in a private yard.

Until about six years ago it was a standing reproach to our naval administration that they showed so much leniency toward the private concerns in the matter of living up to the letter of their contracts, especially the clause regarding rapidity of construction. The bidders, when submitting proposals, were required to state the length of time it would take them to complete the ships for delivery to the government. (It might easily happen that, other conditions being equal, this one factor might determine the award of the contract.) Nevertheless, the time clause was pretty generally ignored, so that frequently ships were not ready for sea five years after being laid down. Indeed, instances are not lacking of government work being practically suspended, so that some merchantman might be hurried to completion.

When Mr. Roosevelt became President, he displayed a keen personal interest in the affairs of the navy, and wherever he found abuses he took prompt steps to put an end to them. In 1902 the "Maine," "Missouri," and "Ohio" were still in the builders' hands, though they had been authorized as far back as 1898; and of the five powerful vessels of the "New Jersey" class, not one was making satisfactory progress. Our new fleet, which Congress had so generously provided for in the years subsequent to the Spanish war, was still mostly on the stocks, and things in general were languishing, when Mr. Roosevelt, seeing at once where the trouble lay, applied the proper remedy. What was needed was competition. Not competition alone between the various yards, but outside competition. So in a message to Congress he recommended that they include in the naval bill, which that year authorized the construction of two battleships, a provision that the Secretary of the Navy might, at his discretion, build one of them at a government navy yard. This he did, and the results which followed transcended expectations. The "Connecticut," of 16,000 tons, was laid down in the New York navy yard; the contract for her sister, the "Louisiana," being awarded to the Newport News Ship Building and Dry Dock Company. Forced thus to compete with the United States government, the Newport News people bestirred themselves, and bent every energy toward finishing the "Louisiana" ahead of her rival.

The "Connecticut" was heavily handicapped at the start, pending the erection of the necessary cranes and shops and the building of a slip; but Naval Constructor Baxter, to whom this important task was intrusted, bravely overcame all obstacles, and set a pace which gave the private yard all it could do to keep up. And this despite their added advantage of being able to work their men ten hours a day to the government's eight. When the "Connecticut" was about two-thirds completed, however, work on her had to be suspended to await the delivery of her armor plate, of which she carries about four thousand tons. She was launched just eighteen months after her keel was laid, thus tying the "Louisiana's" record. The latter, though, was the first to go into commission, only three years and three months after her keel plates were placed upon the ways. This performance proved to the entire satisfaction of the authorities that with sufficient incentive our shipyards could turn out a battleship within a reasonable time; and Congress, acknowledging the success of the experiment, has since included in most of its naval bills a provision giving the Secretary of the Navy power to build battleships at government yards should he deem it advisable. He did not exercise this privilege, however, until two years ago, for the private concerns have lately managed to turn out our ships in even less than the contract time.

In 1908 the Secretary ordered the huge dreadnought "Florida," 21,500 tons, to be laid down at the New York yard, where Constructor Baxter had a splendidly drilled force of workmen putting the finishing touches on the new fleet collier "Vestal," of 12,500 tons, which had then recently left the ways. The "Florida's" sister ship, the "Utah," is being built by the New York Shipbuilding Company, of Camden, N. J., and the rivalry between the two leviathans is even keener than that of the "Connecticut" and "Louisiana." Though these "super-dreadnoughts" are 5,500 tons larger than the older vessels, so great has been the improvement in building methods in the intervening few years, that the "Utah" was launched in ten months, 58 per cent completed, while the "Florida" left the ways in fourteen months with 63½ per cent of the work done. It is expected that both of these mighty vessels will be in commission within two years after they were laid down.

We have now about reached the point where the largest man-of-war may be built quite as quickly on this side of the Atlantic as anywhere in the world, except possibly in England. Germany, urged by her Kaiser, who has made the Fatherland's new navy his special hobby, has so improved her dockyard facilities in the last two or three years, that she can turn out dreadnoughts in from twenty-four to twenty-seven months. France still requires a full three years, and Japan at least that long. In England, the home of steel ships, there are several yards, both government and private, where a dreadnought may be built in a year and a half if necessary. The original ship of that name (that is, the present "Dreadnought") was launched in less than five months, and delivered one year and one day after her keel was laid down. This remarkable and unequaled record was made at the Portsmouth (Admiralty) dockyard in 1905-6.

In the list given below will be found the time it took to complete our newer battleships (those at present composing our Atlantic fleet), and the reader will notice the sudden acceleration which ensued after government competition had taught the private builders that the navy wanted its ships to sail with the fleet, and not to ornament the stocks in a shipyard.

Name.	Builder.	Displacem't. Tons.	Yrs.	Mths.
New Jersey	Fore River I. W.	15,000	4	1
Georgia	Bath Iron Works	15,000	4	5
Rhode Island	Fore River I. W.	15,000	3	9
Virginia	Newport News S. B. Co.	15,000	4	..
Nebraska	Moran Bros.	15,000	5	..
Louisiana	Newport News S. B. Co.	16,000	3	3
Connecticut	N. Y. Navy Yard	16,000	2	9
Minnesota	Newport News S. B. Co.	16,000	3	4
Vermont	Fore River I. W.	16,000	2	9
Kansas	N. Y. Shipbuilding Co.	16,000	3	3
Idaho	Cramps	13,000	3	10
Mississippi	Cramps	13,000	3	9
New Hampshire	N. Y. Shipbldg. Co.	16,000	2	10
South Carolina	Cramps	16,000	3	1
Michigan	N. Y. Shipbldg. Co.	16,000	3	..
North Dakota	Fore River I. W.	20,000	2	6
Delaware	Newport News S. B. Co.	20,000	2	5

IMMUNITY IN PLANTS.

SINCE plants have nothing that corresponds with the blood corpuscles, the conclusion was reached by many botanists that the principle of phagocytosis had no application to the plant world. But now the French botanist, Prof. Noël Bernard, of the University of Caen, has pointed out an obvious analogy between the process described by Metchnikoff and a process that takes place in certain plants.

Most of the diseases of higher plants are caused, not by bacteria or protozoans, but by filamentous fungi, related to the molds. In the roots or underground stems of many of the higher plants—including all the species of the orchid family, the heath family, and many others—there is always present a colony of such fungi. The presence of the fungus does not seem to cause permanent injury to the plant, but does not seem to be of any use to the plant either. Many theories have been advanced as to the significance of this association or symbiosis between the higher plant and the fungus. Prof. Bernard points out that some of these fungi are known to cause diseases in certain plants, and infers that in the orchids, for example, they produce no injury, because when the fungus has penetrated into the interior of the cells, the protoplasm of the latter begins to digest it, in the same way as the white corpuscles of our blood digest invading bacteria.

This view is supported by the fact that there is a progressive degeneration of the fungus within the cells of the host in practically all such associations that have been examined. By means of careful experiments, Dr. Bernard has further shown that in a given orchid a certain fungus will do no harm whatever, being digested and reduced to dead clumps, whereas closely related species of fungi will act in every way like disease-producing invaders.

He concludes that while plants have no moving cells corresponding to the phagocytes of animals that are capable of attacking and devouring invaders, many of the cells in most plants still retain, to a certain extent, the ability to digest any invaders that may get into them. To the extent that this ability is retained the plants will be immune from disease. This brings the curious mycorhiza or root fungus into harmony with Metchnikoff's theory of immunity.

ELECTRICITY.

Our consul at Zanzibar, Africa, calls attention to the increasing use of wireless telegraphy in Africa, and suggests that manufacturers of wireless apparatus should look into this promising field. There are five stations now at Benardir, Zanzibar, and Pemba, and it is planned to establish stations in British East Africa and German East Africa.

The use of the telephone for dispatching trains is meeting with success in New England. A hundred miles of the New York, New Haven and Hartford Railroad is equipped with the telephone system. On the Boston and Maine Railroad the White Mountain division and the Concord division are thus equipped. The main line of the Boston and Albany Railroad has 165 telephone stations, while the Central Vermont Railroad is about to install telephone service on the division from St. Albans to Windsor.

A record transmission voltage for Europe will be established by the Lauchhammer power station in Germany, which will transmit power at 110,000 volts. The different works of Messrs. Lauchhammer, Ltd., have heretofore been supplied from separate power stations. Finding that their works at Lauchhammer were situated on a rich lignite field, it was decided to build a central power plant to supply the various works. At the same time, a central station was being planned at Gröba to supply four districts of the kingdom of Saxony. Arrangements were accordingly made to utilize, instead, the power generated at the Lauchhammer plant. Three turbo-dynamos of 5,000 kilowatts each are being installed, and two more units will be added later. The current is generated at 5,500 volts, and raised by means of transformers to the transmission tension of 110,000 volts. The plant will have a capacity of 40,000 kilowatts, or nearly 50,000 horse-power.

In order to light and heat the Office Building of the Senate and the Office Building of the House of Representatives, as well as the Capitol and Congressional Library, a large power plant has been built by the government. This is situated at Garfield Park. The boiler room of the plant is provided with sixteen watertube boilers, each of 600 horse-power. In the construction of this plant, care has been taken to prevent any interruption of service. All the equipment is provided in duplicate. The generating equipment consists of four 2,000-kilowatt, three-phase turbo-generators, running at 1,500 revolutions per minute, and generating a current at a pressure of 6,600 volts. A 74-cell storage battery plant may be used in case of emergency, to light the plant or the buildings.

In view of the efforts at the present time to curb amateur wireless telegraphers and the protest of the latter against monopoly of the atmosphere by commercial and government stations, it is interesting to note the decision recently handed down in the case of the Lake Shore and Michigan Southern Railroad Company, the Postal Telegraph-Cable Company, and the Western Union Telegraph Company versus the Chicago, Lake Shore and South Bend Railway Company. Suit was brought against the latter company because its 6,600-volt single-phase trolley line affected inductively the lines of the telegraph companies and the signal system of the railroad company. The court held that the use of the single-phase alternating current on one's own premises does not constitute a nuisance, even though the electricity may escape and interfere with the operation of electrical devices on adjoining property; that the companies bringing suit held no monopoly of the atmosphere, and if they found their systems interfered with, that they should provide such mechanical or electrical devices as would protect their lines.

With a view to standardizing methods of testing insulating materials, the American Society for Testing Materials has appointed a committee which will investigate the systems of the different manufacturers. The following is a list of the tests that are to be looked into, and, if possible, standardized: Electrical Tests: Dielectric strength (puncturing voltage); relative dielectric hysteresis; specific inductive capacity: (1) direct current; (2) alternating current; conductivity or insulation resistance; leakage. Physical Tests: Specific gravity and specific weight; hardness; toughness; brittleness; ductility; workability; flexibility (with reference to varnished cloths, etc.); tensile, compressive, and shearing strength; fibrous, crystalline, and amorphous fracture; ability to take polish; melting point; softening point; shrinkage; adhesiveness; effect of high temperature (electric arc); effect of low temperature (extra cold); artificial aging test; porosity; viscosity; flash and fire test; film-making power; rate of drying; penetration; absorption of moisture; amount of volatile matter given off at prescribed temperatures. Chemical Tests: Proximate composition; solubility in water, oil, etc.; effect of moisture and moist air; weathering qualities; chemical effect upon metals in contact; presence of acid.

AERONAUTICS.

There is a movement on foot in France to have the standards bearing high-tension electric cables painted a distinctive color. The danger is obvious enough, so that the suggestion seems worth carrying out.

Competing for the Coupe Femina, Mlle. Marvingt, flying in an Antoinette monoplane, remained in the air 53 minutes, and covered a distance of 45 kilometers. The cup is offered to the woman who flies the greatest distance without stop up to December 31st.

In their annual reports, Major-General Leonard Wood and Brigadier-General James Allen recommend to Congress the appropriation of a sum of money for the purchase of aeroplanes. The art of aviation has assuredly reached such a stage that Congress ought no longer to deny these insistent requests.

In a lecture before the Institute of Civil Engineers of France, Prof. Soreau states that the Aero Club of France has issued over 270 licenses, and that the total number of aviators in the world is about 500. The deaths have been about six per cent. The total distance flown may be estimated at 125,000 miles.

The Aero Club of France has decided to uphold the Royal Aero Club in its protest, instigated by Grahame-White, over the British aviator not being allowed another trial in the Statue of Liberty $10,000 prize race at the Belmont Park meet. It will probably take a year before the matter is definitely settled by the International Aeronautic Federation.

Major Kennedy, at a recent meeting of the Royal Societies Club, discoursed on aeroplane accidents. He classified the causes of forty British accidents at Doncaster, Bournemouth, and Lanark, as follows: Failure of engine and involuntary descent, 13; alighting on bad ground, 10; struck by sudden gust of wind, 6; fire and similar causes, 6; propeller breaking, 5.

The British War Office has decided that Salisbury Plain shall be the flying ground for the British army aeroplane corps. The plain is even now the scene of much aeroplane activity. There army men may be seen in flight almost every day. The type of machine has not yet been decided on. A Paulhan biplane, a Farman biplane, and a two-seated Blériot have been ordered from France. English machines will also be tested.

When the Wright suit against Grahame-White for the use of his Farman biplane comes to trial, M. Henry Farman will probably produce several heretofore unknown foreign patents which he has purchased and which, he claims, clearly anticipate those of the Wright brothers. At the same time the Farman brothers—for Maurice and Henry Farman are now working together—are threatening to prosecute all infringers of the several patents which they hold in common.

After terminating his flying in America with a ten-day exhibition at Philadelphia, Grahame-White returned to England on the 30th ultimo, carrying with him the International Trophy he won at Belmont Park. His earnings during his three months' visit are said to be about $100,000 in cash. The Wrights have sued White for infringement of their patents, and he expects to return in a month to defend the suit. Before leaving, he ordered seven biplanes from the Burgess Company and Curtiss. This is the largest single order yet given in the United States.

It has not yet been definitely determined whether or not Mr. J. Armstrong Drexel broke the late Ralph Johnstone's height record of 9,714 feet. Before making his attempt, Mr. Drexel had his Richard barograph tested by Queen & Co., of Philadelphia, who make a similar instrument. The barograph was verified up to a height of but 9,600 feet, however. During the past week the National Council of the Aero Club of America had the barograph tested by Messrs. Snyder & Co. of New York, who claimed that Mr. Drexel had only reached a height of 9,450 feet instead of 9,970, as at first reported. The instrument has been returned to Queen & Co. for a final test, which will be made under the supervision of officers of the Weather Bureau. In case it is found that Johnstone's record was not beaten, Mr. Drexel intends to make a new trial.

It seems that Augustus Post and Allan R. Hawley did not break the world's record for long-distance ballooning, after all. An official report made by the War Department shows that Comte de la Vaulx's distance of 1,193 miles, made in a flight from Paris to a point in Russia, has not been beaten. The official record made by the "America II." was 1,171.13 miles. The records made by the other entrants are as follows: The "Düsseldorf II.," pilot Gericke, 1,131 miles; "Germania," pilot Capt. von Abercron, 1,079 miles; "Helvetia," pilot Col. Schaeck, 826 miles; "Hamburg III.," pilot Lieut. Vogt, 766 miles; "Azurea," pilot Capt. Messner, 756 miles; "Isle de France," pilot Alfred Leblanc, 722 miles; "St. Louis IV.," pilot H. E. Honeywell, 552 miles; "Condor," pilot Jacques Faure, 413 miles; "Million Population Club," pilot Von Phul, 317 miles.

SCIENCE.

The prize of £20 offered by the Scottish Meteorological Society for competition among students and graduates of the Scottish universities for the best essay on a meteorological subject has been awarded to David MacOwan, of Edinburgh University, for an essay on "Observations in Atmospheric Electricity in and near Edinburgh."

From a recent report of the Japanese Resident General in Korea it appears that the official meteorological work of that country has been transferred to the Agricultural Bureau, and that forty-five meteorological stations were in operation in 1908, while storm signals were displayed at eleven seaports. The central observatory is at Chemulpo.

In its last annual report the British Meteorological Office announces that it has in preparation the following special publications among others: "The Computer's Handbook," "The Seaman's Handbook," "Gales on the British Coasts" (a revised edition of the "Fishery Barometer Manual"), "The Seasons in the British Isles," "Atlas of Tropical Hurricanes."

The Japanese Antarctic expedition, under Lieut. Shirase, started on Monday, November 28th, from Shinagawa Bay aboard the 450-ton schooner "Kainan Maru." It is admitted that the Japanese equipment is so poor that it is not likely that the expedition can accomplish much. The crew of the schooner consists of fifteen picked men. Manchurian ponies will be employed, following the example of Shackelton.

Prof. Roy C. Andrews, of the American Museum of Natural History, has returned to New York, and has brought with him some very remarkable specimens from Asiatic waters. One of them is a new species of porpoise, captured off the coast of Japan, another a new variety of whale, likewise caught not far from the Japanese coast. The new whale, which Prof. Andrews christened the "Sardine Whale," grows to a length of about fifty feet, is more slender than the humpback or sperm whale, and commercially is of less value.

No star has yet been found with a parallax as much as one second of arc, and it is practically certain that there exists none near enough to have that amount of parallax. In the southern hemisphere there is a bright star, known as Alpha Centauri, with a parallax of three-quarters of a second. The distance of this nearest of all stars is about 26 millions of millions of miles—nearly three million times as far from us as the sun, a distance from which light would take four and one-quarter years to reach us. Something is known now of the parallax of some 360 stars, but in many of these cases the result is exceedingly uncertain.

Sir W. Crookes states that scandium has been found to the extent of more than one per cent in the mineral wilkite from Finland, and in small amounts for many other minerals. By a systematic series of fractionations it is possible to separate scandium from most associated elements; ytterbium is the most difficult to separate because its nitrate is decomposed almost as readily as scandium nitrate. In view of the atomic weight relationships, and of the frequency with which these elements occur together in nature, it is suggested that yttrium and scandium are degradation products of ytterbium. Scandium can be separated from yttrium and ytterbium by precipitation as meta-nitrobenzoate.

For producing perfect asepsis of wounds and of areas that have to be prepared for surgical operations, especially where a thorough scrubbing would involve considerable pain, tincture of iodine of official strength has proved itself entirely satisfactory in a large number of cases, and its application for this purpose is rapidly extending, particularly in Germany. The tincture is applied by means of a brush, in thin layers, without previous cleansing of the wound or surface, except that sometimes benzine and alcohol are used to remove excess of grease. Inflammation from the iodine is very rare, and this danger is more than compensated by the advantages of the method.

By means of experiments carried on during the past summer at the Biological Laboratory of the U. S. Bureau of Fisheries, at Woods Hole, Mass., G. G. Scott, of the College of the City of New York, and G. F. White, of Richmond (Va.) College, have determined that the gills of fishes are permeable to salts. The experiments consisted in making chemical analyses of the blood drawn from a salt-water fish that had been placed in fresh water, the blood being sampled at intervals of from thirty to forty-five minutes. Not only does the blood of the fish become diluted through the absorption of fresh water through the gills, but there is an actual loss of salts from the body. These results are in harmony with those obtained by Dr. F. B. Sumner, director of the government laboratory at Woods Hole, five years ago, and explain, at least in part, the death of salt-water fish placed in fresh water, and *vice versa*.

AN ENGLISH AUTOMOBILE TURBINE FIRE PUMP

BY FRANK C. PERKINS

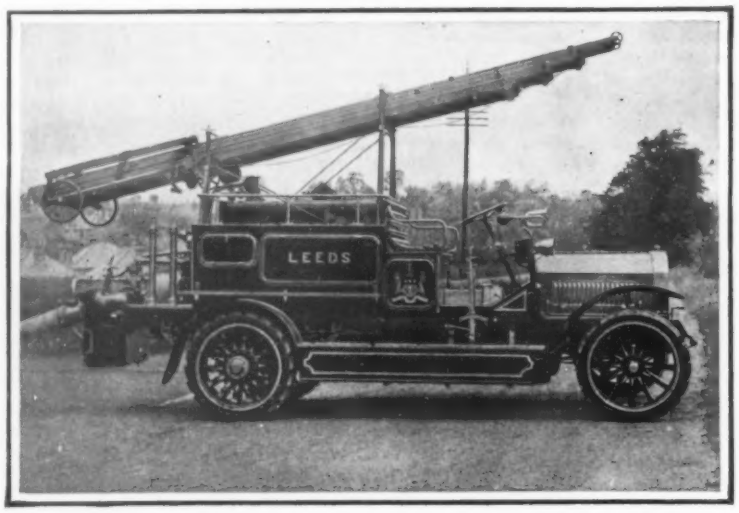
A century ago the best fire brigades were provided with manual fire engines, although the usual fire fighting appliances consisted of a hand squirt and a number of buckets. Later, a combined pedal and hand pumping machine was devised, and fortunate indeed was the fire brigade owning one of these equipments, the steam fire engine being then unknown. Somewhat over six decades ago the first steam fire engine was built. It was self-propelled, and the engine served the dual purpose of propelling and pumping. It was not a success however, as the weight was too great and the cost of construction and maintenance was such that the self-propulsive idea was abandoned.

The horse-drawn steam fire engine was evolved from the last named apparatus, and has probably reached at the present date the highest degree of perfection which its form of construction permits. The one thing that it lacks is speed, which can be given to it only through the abandoned steam-propelling system.

It is well known that the steam motor fire engine now in use is almost as heavy as the first one constructed, and is not only costly to run, but is a continual expense day and night, as steam must be kept up when in the station.

The gasoline engine or internal combustion motor has solved the difficulty of the motor steam fire pumps, as it is as well suited for pumping as for propelling. While steam engines require furnaces and boilers, and electric motors require accumulators or storage batteries, the gasoline motors need nothing but a small carbureter and a fuel tank. Besides they are self-contained and can be started up with a single turn of the starting handle. The motor fire pump is infinitely superior in point of speed and first cost as well as economy in operation, and they combine quietness and long life with their other good points.

The Leeds auto fire engine shown in the accompanying illustration has a capacity of 350 gallons, and is operated by a four-cylinder engine of 55 brake horsepower. This auto fire car has four speeds forward and one reverse, with a normal speed of 35 miles per hour under load. It will deliver 350 gallons of water at 120 pounds pressure, throwing a 1⅛-inch jet 160 feet high. The turbine-pump is self-charging and automatic in its action. The car is equipped with block section tires and provided with a 45-foot fire-escape ladder. Seven similar auto fire engines are operated by the London Fire Brigade, and others of this type are in the fire service of several English cities.



AUTOMOBILE TURBINE FIRE PUMP IN USE AT LEEDS AND OTHER ENGLISH CITIES.

The pump, of the centrifugal rotary or turbine type, has a single casing designed to do exactly the same work as those usually requiring three or more casings. By this means the weight is reduced to less than half and the efficiency increased. It has, too, the important feature, that the incoming water enters equally on both sides and obviates end thrust, which is a serious defect in other makes of pumps of this type. The pump is self-charging, so all that is required is to drop the suction hose in the water and to start the engine, when instantly the pump is in full operation. A very special advantage about this pump for fire purposes is, that presuming at the side of the fire there is a water main carrying pressure, such a main can be connected directly to the suction of the pump and the pump will add to such pressure. This is an important feature, as the pressure in the mains is wasted by letting the water out into a suction tank and then drawing it up again, or by the obstruction offered by the operation of the valves if the hydrants be direct coupled to the suction head.

In the Leeds auto fire engine the transmission system from the engine to the pump is exceedingly simple, as geared to the clutch shaft driving the road wheel gears is another shaft which has no connection whatever with the road gears. Normally, the pump shaft is not in gear with the clutch shaft, but as soon as the vehicle stops at a fire a small lever is pulled over and the pump shaft is thrown into gear with the clutch shaft, which is still being driven from the engine. The road gears are in the "neutral" position when the pump is at work.

It is maintained that it is impossible to burst the delivery hose by shutting off the water while the pump is running, as would happen with ordinary thrust or piston pumps. All that would happen would be the running of the vane vessel through the pump chamber past the water inclosed therein. The delivery hose is controlled by separate regulator valves; consequently, shut-off nozzles may be used and unnecessary water damage prevented.

In English fire departments the charging apparatus of the fire pumps is used as a first-aid machine when the main pump supply is not required. By starting the pump, a continuous supply of water from a 50-gallon charging tank is delivered through a 1-inch hose with 5/16-inch nozzle, the supply being maintained by coupling a hydrant to the tank. The engine drives the pump and maintains the requisite pressure. The main line of 2½-inch or 2¾-inch hose can be brought into play at any time, while the 1-inch first-aid hose is at work should the fire assume serious proportions.

A NOVEL ERGOGRAPH

BY DR. ALFRED GRADENWITZ

One of the most important factors in connection with psychological research work is the variable strength of a given muscle. In order to ascertain this, a number of apparatus termed ergographs have been constructed, the most well-known of which is the Mosso apparatus. As, however, none of the arrangements so far designed actually complies with such conditions as are entailed by the very nature of muscular work, Prof. J. Athanasiu of Bucharest University has constructed on quite novel principles the ergograph represented in the accompanying illustration.

The weight to be lifted, which serves to determine the muscular effort, is a perfectly spherical massive steel ball sliding on the two aluminium plates seen on the bench placed against the left end of the experimental table. The two plates are hinged round a horizontal axis, their edges being bent conveniently so as to prevent the ball from falling to the floor.

The subject to be experimented on is seated at the experimental table, his arms being strung to two wooden planks which are likewise hinged round a horizontal axis. Non-extensible strings connect each of the planks with one of the aluminium plates so that by pushing down either of the planks, the corresponding aluminium plate, and along with it the steel ball, is lifted more or less according to the strength of the subject.

The plate thus lifted forms an inclined plane along which the ball will roll down toward the other side, a wall lined with a flannel cushion serving to damp the impact. As the ball during the time the aluminium plate is lifted should remain at the free end of the latter, a convenient arrangement consisting of five longitudinal slots fitting into a series of wooden bars has been provided to prevent the ball from recoiling.

A SUBJECT UNDER A TEST OF MUSCULAR STRENGTH IN POSITION AT A DOUBLE ERGOGRAPH.

The lifting curve which represents the muscular effort of the subject is recorded by an electrically operated signaling style, consisting of a straw, pivoting upon a horizontal axis, and which at its end carries a soft iron armature acted upon by an electromagnet. The electric circuit contains the aluminium plates and three thin transversal wires.

The ball rolling up and down in its aluminium trough produces two current closures which are recorded by the style above described. The lifting curve thus comprises two interruptions corresponding to the beginning of the ball motion and to the passage of the ball from one plate to the other respectively.

A special feature of this double ergograph is, that the weight to be lifted will decrease as the contraction of the muscle proceeds, in order finally to become *nil*. As the weight, after the muscular contraction has been completed, loses any connection with the muscle, the latter only performs positive work, returning quite freely into its position of rest. Again, the new apparatus allows permanent work to be readily performed. It enables two muscles of the same or different persons to be checked with one another and would seem to be especially adapted for use in gymnasiums where records of the muscular development of athletes under different methods of training could be made and from these the value of the different muscle-developing apparatus determined.

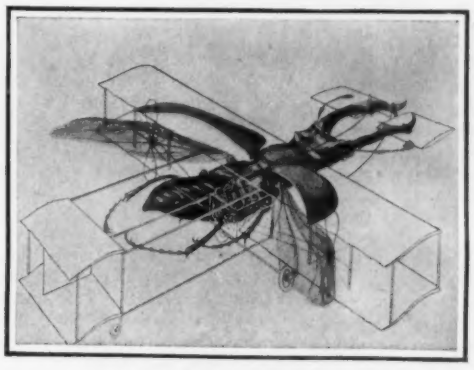
FLYING MACHINES, LIVING AND LIFELESS

WHAT MAN HAS LEARNED FROM NATURE

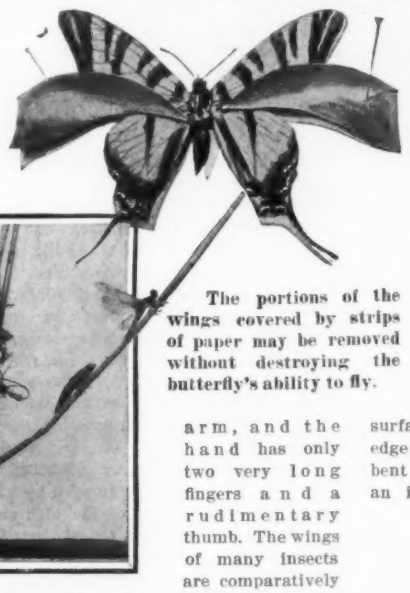
The art of flying must be learned from birds and other flying creatures, and the study of their anatomy has contributed much to the development of the aeroplane. The great schools of aviation are the ponds covered with dragon-flies, the fields gay with fluttering butterflies, and the lofty cliffs whence the great soaring birds of the sea take their flight. From birds and insects man has learned how to leave the earth, to rise, advance and change his course, and to land with safety, and the sustaining surfaces of the aeroplane are imitations of living wings.

The structure of a bird's wing is not generally understood, because it is usually concealed by rapid movement or by the folding of the wing when at rest. In soaring flight, the wing assumes a comparatively simple form, slightly convex above and concave below. The wing of a bird corresponds to the arm and hand of a man, but the homologous parts do not have the same relative dimensions in the skeletons of the two members. The forearm of the bird is longer than the upper arm, and the hand has only two very long fingers and a rudimentary thumb. The wings of many insects are comparatively simple and invariable in form, consisting of a frame of horn-like fibers covered with a thin and usually transparent membrane.

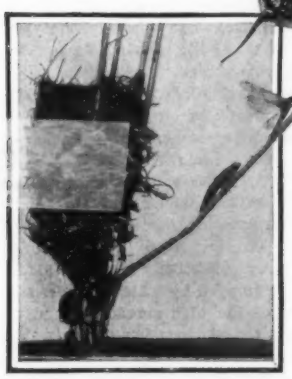
The long and slender form of soaring birds facilitates their flight.



One of nature's biplanes in flight.



The portions of the wings covered by strips of paper may be removed without destroying the butterfly's ability to fly.



A dragon fly which has just emerged from its pupa skin (shown behind the insect).

A wonderful spectacle is presented by the sudden apparition of an insect's wing at the completion of its metamorphosis. The transformation of the grub into the butterfly, though familiar, is none the less amazing, but the evolution of the active and gossamer-winged dragon-fly, from its ugly and sluggish aquatic pupa, is still more impressive. Early on a May morning the pupa emerges from its cocoon at the bottom of a ditch, swims on its back, by paddling with its long-haired paws, to the stem of an aquatic plant, and climbs up out of the water. Then, after a momentary pause, the skin suddenly bursts open and the perfect insect appears, with closely folded wings, which soon unfold and assume their final form. The older naturalists thought that the insect "swallowed air," with which the wings were inflated. In reality the air is absorbed in the digestive organs, causing an increased blood pressure which mechanically expands the wings. The presence of dew is also necessary, hence the first flight is always made at dawn. This spectacle of the birth of a wing may be observed in dragon-flies reared in an aquarium, the atmosphere of which should be moistened with an atomizer when the pupa rises to the surface.

Man, like the dragon-fly, now appears to be emerging from his humble larval existence and expanding his wings in flight.

The most successful fliers, among birds and insects, pass before our eyes so swiftly that we cannot observe the mechanism by which they are sustained and carried onward. The secret of flight can best be learned from a bird which flies slowly and heavily. A hen, in attempting to fly, runs rapidly over the ground, leaps high into the air, and beats her wings furiously, with an effort that often elicits cries of pain. These actions explain themselves. The hen runs because a great horizontal velocity makes it easier to rise, and her wings are so small that they must be flapped violently in order to take sufficient hold on the air. Eagles, vultures, and other large-winged birds do not need to move their wings so energetically, but they, too, are compelled to leap upward in order to rise from a level plain.

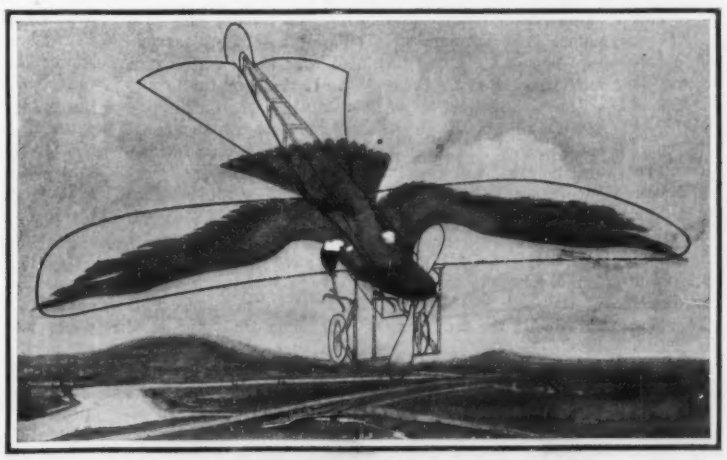
A bird's wing, in its downward stroke, presses and rests upon the air beneath. Why is not the upward impulse thus produced followed by an equal downward impulse when the wing is raised? On the down stroke the free edge of each feather is held down by the strong quill of the next, which lies over it and against which it is pressed by the air, so that the whole wing forms a continuous resisting surface. On the up stroke, on the contrary, the free edge of each feather, being unsupported beneath, is bent downward by the air pressure above, leaving an interstice between it and the next feather, so that the wing moves upward through the air with comparative freedom. These movements of the feathers are shown clearly by Marey's instantaneous photographs. Nothing similar to this is possible with an insect's wing, which is made of one piece, but the mechanism of the flight of insects was also revealed b the instantaneous photographs and experiments of Marey and Pettigrew. Although these two investigators engaged in lively controversies and their theories differ in detail, both demonstrated, almost at the same time, that the tip of an insect's wing describes a figure 8 and that the plane of the wing changes, so that the wing, as nearly as the continuity of living tissues permits, opposes its entire surface to the air on the down stroke and cleaves the air with its edge on the up stroke. Marey determined this helical movement by holding a glass rod, blackened in a flame, against the wing of an insect struggling to escape.

Marey's experiment, showing helical movement of an insect's wing.

Skeleton of a bustard, showing rudimentary thumb and relative lengths of wing bones.

The great soaring birds, which make the longest and loftiest flights, flap their wings very little. The flight of a soaring bird is a succession of glides down almost imperceptibly inclined planes. Drzewiecki has calculated that if a soaring bird, starting from an elevation of 3,300 feet, falls with its wings held rigidly at the most favorable inclination to the horizon, it will strike the ground at a point more than 14 miles distant from its starting point. Hence an eagle, swooping from its mountain eyrie, may soar completely across the field of view without flapping its wings and without descending perceptibly. When a sea breeze blows against the face of a lofty cliff it is deflected upward. Under these conditions a bird starting from the top of the cliff may actually rise to a much greater height without flapping its wings. In extended flights in still air, the course of a soaring bird is zigzag, or undulating, in a vertical plane. Long and very slightly inclined downward glides, accomplished by soaring alone, alternate with steep and short ascents, effected by a few strokes of the wings. In a perfectly steady and uniform wind the path is the same, relatively to the moving air, while the bird's motion, relatively to the ground beneath, is the resultant of its motion, relatively to the air, and the motion of the air itself. It is often asserted to-day, as it was asserted by Leonardo da Vinci in the fifteenth century, that

(*Concluded on page 468.*)



A monoplane compared with a soaring bird.

FLYING MACHINES, LIVING AND LIFELESS.

RULES GOVERNING THE COMPETITION FOR THE $15,000 FLYING MACHINE PRIZE OFFERED BY MR. EDWIN GOULD.

1. A prize of $15,000 has been offered by Mr. Edwin Gould for the most perfect and practicable heavier-than-air flying machine, designed and demonstrated in this country, and equipped with two or more complete power plants (separate motors and propellers), so connected that any power plant may be operated independently, or that they may be used together.

CONDITIONS OF ENTRY.

2. Competitors for the prize must file with the Contest Committee complete drawings and specifications of their machines, in which the arrangement of the engines and propellers is clearly shown, with the mechanism for throwing into or out of gear one or all of the engines and propellers. Such entry should be addressed to the Contest Committee of the Gould-Scientific American Prize, 361 Broadway, New York city. Each contestant, in formally entering his machine, must specify its type (monoplane, biplane, helicopter, etc.), give its principal dimensions, the number and sizes of its motors and propellers, its horsepower, fuel-carrying capacity, and the nature of its steering and controlling devices.

3. Entries must be received at the office of the Scientific American on or before June 1st, 1911. Contests will take place July 4th, 1911, and following days. At least two machines must be entered in the contest or the prize will not be awarded.

CONTEST COMMITTEE.

4. The committee will consist of a representative of the Scientific American, a representative of the Aero Club of America, and the representative of some technical institute. This committee shall pass upon the practicability and efficiency of all the machines entered in competition, and they shall also act as judges in determining which machine has made the best flights and complied with the tests upon which the winning of the prize is conditional. The decision of this committee shall be final.

CONDITIONS OF THE TEST.

5. Before making a flight each contestant or his agent must prove to the satisfaction of the Contest Committee that he is able to drive each engine and propeller independently of the other or others, and that he is able to couple up all engines and propellers and drive them in unison. No machine will be allowed to compete unless it can fulfill these requirements to the satisfaction of the Contest Committee. The prize shall not be awarded unless the competitor can demonstrate that he is able to drive his machine in a continuous flight, over a designated course; and for a period of at least one hour he must run with one of his power plants disconnected; also he must drive his engines during said flight alternately and together. Recording tachometers attached to the motors can probably be used to prove such performance.

In the judging of the performances of the various machines, the questions of stability, ease of control, and safety will also be taken into consideration by the judges. The machine best fulfilling these conditions shall be awarded the prize.

6. All heavier-than-air machines of any type whatever—aeroplanes, helicopters, ornithopters, etc.—shall be entitled to compete for the prize, but all machines carrying a balloon or gas-containing envelope for purposes of support are excluded from the competition.

7. The flights will be made under reasonable conditions of weather. The judges will, at their discretion, order the flights to begin at any time they may see fit, provided they consider the weather conditions sufficiently favorable.

8. No entry fee will be charged, but the contestant must pay for the transportation of his machine to and from the field of trial.

9. The place of holding the trial shall be determined by the Contest Committee, and the location of such place of trial shall be announced on or about June 1st, 1911.

The provision of a quick stoppage is an advantage hitherto restricted to direct-current motors, which can act as generators; with alternating induction motors the braking must be produced by external means. A suggestion of Mr. A. Héreng is given in L'Industrie Electrique for removing this drawback, by providing a suitable excitation for the stator of an induction motor during the act of stopping, which enables the rotor to generate alternating currents and thus to absorb energy. The desired end may be attained by coupling a small series direct-current machine to the motor, connected so that when the main circuit is opened, the direct-current machine is coupled to one of the stator phases and excites the field, while the rotor is either short-circuited or connected to a resistance. Alternately a rectified current derived from one of the rotor phases—in the case of a wound rotor with slip rings—may be used to excite the stator field, the current being rectified either by an electrolytic valve, a commutator, or other means.

SOME INCIDENTS IN THE EARLY LIFE OF FERRANTI.

BY A. J. JAGMAN.

Sebastiani Ziani de Ferranti, the newly-elected president of the British Institute of Electrical Engineers, is the son of Cæsar Ferranti, an eminent photographer of Bold Street, Liverpool, England. It was at St. Augustine's College, Ramsgate, Kent, that Mr. Ferranti, who was being educated there, met with an accident that nearly caused the loss of his eyesight, while fitting up an electric bell between the college and the monastery. One of his battery carbons was broken, and he endeavored to join the two ends together and fasten them with a lead bond. The carbon pieces were suitably drilled and molted lead was poured into the hole; but the young experimenter had neglected to dry the carbon thoroughly, and as a consequence, there was an explosion due to the instant conversion of the moisture into steam. Molton lead was thrown into his face, blinding him for a time, and burning him badly. This was in 1879.

The first dynamo Ferranti ever saw was at 41 Queen Street, Ramsgate. It was driven by hand power, and was fitted with shuttle-wound H-pattern Siemens armature. In 1881 Mr. Ferranti became located in London. It was at No. 10 Glenarm Road, Lower Clapton, that Mr. Ferranti commenced the design of a new alternating current dynamo. His idea was to convert Faraday's disk into a practical armature. Here Mr. Ferranti and the writer often conversed upon the subject, and during his stay at this address the photograph herewith published was made. It was taken at night by the light of an arc lamp, with an exposure of four seconds. The current was furnished by a 44-cell bichromate battery, and the arc

FERRANTI IN 1881. PHOTOGRAPHED BY THE LIGHT OF AN ARC LAMP OF HIS OWN CONSTRUCTION.

was fitted with a 6-millimeter positive carbon and a piece of quarter-inch copper wire for the negative pole. This was probably the earliest use of a copper pole in an arc lamp.

In 1882, Ferranti had completed the design of a new alternating current machine, and had protected his invention with a patent. The machine was made at the writer's electrical workshop, then at 25 Richmond Street, St. Luke's, London. The machine was tested here, the magnets being excited by a current of 16 amperes at 65 volts from a shunt-wound dynamo. It lighted 42 16-candle-power incandescent lamps on a parallel circuit, the available power being insufficient to produce the best effect. It was here that Sir William Thomson (late Lord Kelvin) saw this machine at work lighting the lamps. The design of the machine was similar to that of his own "mouse mill" machine. The dynamo weighed half a ton. The armature copper strip was insulated with black cotton tape made and fitted by the writer. It was eventually presented to the Museum of Patents at South Kensington. The making of the cotton strip armatures and magnet coils was carried on in the writer's workshops for several months, and eventually these alternating current generators were manufactured at the Appold works by Ferranti, Thomson, and Ince.

Ferranti's 10,000-horse-power alternating generator was fitted at Deptford. Much to his surprise, it was found that the electro-motive force was much higher at the end of the line than at the generator. This was due to the fact that the concentric conductor acted like a Leyden jar. This came to be known as the Ferranti effect. The difficulty was eventually overcome. It entailed a loss of 16 amperes at 10,000 volts in a 6-mile conductor, due to static charge.

In Mr. Ferranti the Institute of Electrical Engineers has chosen a man of high electrical skill and mechanical qualifications, having gone through the mill of practical experience. His alternating current meter, as well as the current generator, will stand as monuments to his skill and ability.

[Note.—Mr. Ferranti's presidential address before the Institute of Electrical Engineers was unusually interesting. It is republished in full in the current Scientific American Supplement.—Ed.]

OIL LOSSES BY FIRE.

BY CHARLES A. SIDMAN.

It has been estimated by the Geological Survey of the Department of the Interior that there is lost annually more than a million and a half barrels of oil by the burning of oil wells, and from other causes.

The greatest loss is during the months of May to October, and is occasioned by any number of causes. The principal one seems to be the careless use of matches. Other reasons which cause fires in oil wells are from lightning, from the spark of an automobile, and from the gases which emanate from the wells.

It sometimes happens also that a well is flowing at such a great rate that the bearing of the pump may develop a serious leak, and spray a great many barrels of oil on the ground before it can be stopped. If a thunder storm should arise at that time, there is danger of the well's catching fire from lightning, and causing a great deal of damage as well as loss of life.

A case of this kind happened this past spring in the State of Louisiana, with a very large well which had a flow of oil variously estimated at from 8,000 to 25,000 barrels a day. A leak developed which could not be stopped at once, and while waiting for suitable machinery to arrive, a severe thunder storm broke out. The well had been spraying oil from the leak for several days, drenching the men working near it, which made it especially dangerous for them, for it happened that the oil was of such a gravity that it contained about twenty per cent of gasoline and was very inflammable.

The men who were working on the well are termed "greasy men," and when this storm came up were ordered to a nearby stream of water, so that if lightning did strike the well they could plunge in and thereby save themselves.

The well was struck, and there immediately began a fight to extinguish the fire. The gases in the well threw the oil to a great height, causing danger to life and property as well.

The simplest method to extinguish the fire seemed to be to drown it out by means of steam. Twenty-five steam boilers were secured from a nearby city, brought to the well, and attachments made with a nearby natural gas well, and the fire was extinguished within forty-eight hours. For several hours afterward the ground was sprayed with hot steam to be sure that no fire remained.

There are several ways of effectively stopping a fire in an oil well. It can be stopped by water to a certain extent, but the danger of the oil's spreading, and of the vapor thrown off by the evaporation of the water does not make it safe to try this method with a large fire. In cases of small fires it might answer, but not always. Steam driven by force pumps is an effectual means of killing a fire, and is resorted to in most cases. In many of the oil fields one will see many buckets of sand lying around the wells. Aside from being a cheap method of fighting fire, it is also one which can be performed with ease, for a man can pick up a bucket and stop an incipient fire almost as soon as it has started.

Many of the large and modern oil companies have had installed in their fields and near their refineries a system of high-pressure water pipes for use in such cases of sudden fires. High-pressure steam pipes are also run into the fields for the same purpose. It is interesting to note in the case of a field of tanks, the means taken to prevent fires. The majority of the tanks have a sort of sprinkler system installed. A large iron pipe is placed around the top of the tank. This is punched full of holes, and at the outbreak of a fire the high pressure is turned on, which causes a flow of water to run down the outside of the tank. At the same time hot steam is introduced inside of the tanks by the same means as the water is, which prevents the gases or vapor inside of the tank from catching fire. If the tank does begin to burn from the top, then the oil is pumped from the bottom of the tank into another one, thereby saving a great deal of the oil.

One of the principal and most important positions with any oil company is that of fire marshal. It is his duty to know the position of all the fire plugs, just what connections are to be made, and to take complete charge in cases of fire. Upon this "emergency man" depends the saving and salvation of the oil men.

There are discovered from time to time what are known as freak wells. One in particular is located in Mexico. It was drilled with every indication of producing a big supply of oil. After the nitro had been set off there gushed forth a volume of hot water, mud, stones, and very little oil. The gases in the oil and the force of the explosion caused the opening, which

was sixteen inches at the start, to widen out so much that this time it spread over an area of more than forty acres. At the time it spouted, the woods around it caught fire, and many thousands of dollars was spent in putting it out. At this time very little oil is taken from the well, and its spoutings are intermittent.

There are many erroneous ideas as to the handling of kerosene and gasoline. It is not generally known that oil, that is, kerosene, is not explosive. A simple experiment can be tried to demonstrate this fact. Place a small saucer of kerosene on a table, and throw a lighted match into it. In every case the oil will put out the light from the match. Gasoline also is not explosive. It is the vapor thrown off from the gasoline that causes the explosion. In the case of kerosene, the flame is put out because the oil is cold and there is no vapor. But hold a match to a wick which feeds on oil and you can light the wick. That is because there are but few drops of oil on the wick, which draws more oil when that is exhausted.

The petroleum market has advanced to such an extent, that all modern locomotion is now by gasoline or oil. The auto and aero also use gasoline, and where formerly the auto used steam, now the only article is gasoline.

The Current Supplement.

There are few subjects more important to the people of this country than the question of the ever-growing rate at which we use up our coal supplies. Just how to effect true economy in the use of our natural fuel resources was the subject of a brilliant paper by Mr. S. Z. de Ferranti before the Institute of Electrical Engineers. He outlined a plan for converting the whole of the coal which we use for heat and power into electricity and the recovering of its by-products at a comparatively small number of great electricity-producing stations. Mr. Ferranti's paper attracted much attention in England. In the current issue of the SUPPLEMENT, No. 1823, will be found his paper and also a critique of his views, republished from a well-known English journal.—This being the holiday season, readers of the SUPPLEMENT will no doubt peruse with interest an article on "Up-to-date Toys."—Mr. J. R. Barnet describes the motor lifeboats of the Royal National Lifeboat Institution.—The first Norwegian electric steel works is described, in which the Hiorth system is adopted.—In the year 1896 the Dutch physicist Zeeman discovered that the two yellow lines into which the light of a Bunsen flame colored by sodium is resolved by the spectroscope, become broader when the flame is placed between the poles of a powerful electro-magnet, and resumed their normal width when the current which energized the magnet was turned off. The current SUPPLEMENT gives an excellent simple analysis of this so-called Zeeman effect, an analysis which ought to explain to every man who has no technical education just what the Zeeman effect is, and what causes it.—Mr. Lindon Bates, Jr., writes on "The Briquetting of Coal in Belgium."—Mr. Arthur R. Colburn presents the second installment of his new solutions of the famous Pons Asinorum problem in geometry.

Official Meteorological Summary, New York, N. Y., November, 1910.

Atmospheric pressure: Highest, 30.37; lowest, 29.49; mean, 29.81. Temperature: Highest, 65; date, 2nd; lowest, 29; date, 20th; mean of warmest day, 58; date, 2nd; coolest day, 35; date, 20th; mean of maximum for the month, 46.7; mean of minimum, 36.4; absolute mean, 41.6; normal, 44.0; average daily deficiency compared with the mean of 40 years, 2.4. Warmest mean, 50, in 1902. Coldest 37, in 1873. Max. and min. for November for 40 years, 74 and 7. Average daily excess since January 1st, 2.1. Precipitation: 4.62; greatest in 24 hours, 3.16; date, 3rd and 4th. Average for November for 40 years, 3.44. Accumulated deficiency since January 1st, 7.15. Greatest precipitation, 9.82, in 1889; least, 0.75, in 1908. Wind: Prevailing direction, west; total movement, 10,506 miles; average hourly velocity, 14.6 miles; maximum velocity, 46 miles an hour. Weather: clear days, 2; partly cloudy, 14; cloudy, 14; on which 0.01 inch or more of precipitation occurred, 8. Relative humidity, mean of 8 A. M. and 8 P. M., 68.6. Heat and moisture summary of the autumn: Average temperature, 56.03; normal, 55.37. Average precipitation, 3.35; normal, 3.58. Average humidity, mean of 8 A. M. and 8 P. M., 69.53.

Of fifteen adjudicated patents reported in the Patent Office Official Gazette of November 8th, 1910, it is noted that seven patents were held to be valid and infringed, four patents were held valid and not infringed, and one patent was held void as a mere aggregation of old parts, two patents were held void for anticipation, and one patent was held void for lack of patentable novelty. Eleven patents, it will be noticed, were held valid.

Correspondence.

OLD BALLOON VOYAGES TO CANADA.

To the Editor of the SCIENTIFIC AMERICAN:

In connection with the letter of O. H. Ingram, Eau Claire, Wis., published in your issue dated November 26th, on page 419, the following may be of interest:

About 1854 one La Fountaine and another whose name I never knew, or have forgotten, started in a balloon from St. Louis, Mo., and floated northeasterly over Illinois, Indiana, the whole length of Lake Erie and Lake Ontario, landing, the day after starting, on the shore of Lake Ontario, a little south of Sackett's Harbor. According to the description of this trip in the newspapers of that time, this balloon continued at a comparatively low altitude, estimated at about 400 or 500 feet above Lake Erie, and falling lower over Ontario, falling so low at the last that all ballast and the outer garments of the sailors were thrown off; and before reaching the shore the men climbed into the rigging and cut away the basket, and even then, for the last few miles, they would touch water and jump again, such jumps growing shorter until at the last they were dragged ashore wet and nearly naked. The balloon landed on the sandy beach, and was stopped without serious damage in low trees on the bank of the lake.

A few days later, the same parties made an ascent from Watertown, N. Y., the afternoon of July 4th, as I now recall, a great crowd being present to witness the same. I was living with my parents at Diamond Lake, Lake County, this State, and father and mother were visiting relatives in Oswego County, New York, and Watertown, near which my grandmother was living. They saw this exhibit at Watertown, and mother gave a description of the same. The balloon sailed away to the northeast, and was not heard of for many days. La Fountaine and his companion were found by lumbermen after they had traveled two or three days, and then with help returned, found the balloon, which had been damaged and I believe cut and in part taken away, supposedly by Indians, but much of it was rescued and taken back to civilization.

Such is the history as told by my parents and the papers of that time, as they rest in my memory. To my sons and friends I have narrated these events from time to time, as the subject of ballooning has come up for discussion, and they are substantially correct as told above. R. J. BENNETT.

Ravenswood, Chicago, Ill.

To the Editor of the SCIENTIFIC AMERICAN:

In replying to the letter of Mr. O. H. Ingram, recently published in the SCIENTIFIC AMERICAN, in reference to the remains of a balloon found many years ago in the wilds of Canada, north of Ottawa, I can say that they were the remains of one of the most famous balloons and the result of one of the longest and most remarkable balloon voyages ever made. In August, 1859, Prof. Wise, the celebrated aeronaut, and John La Mountain made their memorable voyage of over 1,000 miles, from St. Louis, and landed on the eastern shore of Lake Ontario, in Jefferson County, New York. I was then a boy, living in Theresa, in that county, and remember the circumstances well and the still more tragic event that followed. Mr. John A. Haddock, of our town, a man of adventurous and enterprising disposition, induced Prof. La Mountain to take him up in the wonderful balloon. They ascended from Watertown one fine afternoon, September 22nd, 1859, and disappeared as if swallowed up in the clouds. Nothing was seen or heard from them for twelve days, when a telegram announced their arrival at Ottawa in safety. After traveling all night, they had landed the next day in an unknown wilderness, 180 miles north of Ottawa, in entire ignorance of their location or the distance they had traveled. They then wandered for six days with incredible hardship, going four days without a mouthful of food. On the verge of starvation, they were rescued by lumbermen, as described by Mr. Ingram. The full story is in Haddock's "History of Jefferson County, New York." BYRON A. BROOKS.

New York, N. Y.

A new feature in Shawia is, says the British consul at Casablanca, Morocco, the notable growth in the number of large foreign-owned farms. On some of these farms up-to-date agricultural machinery and implements are in use. Light iron plows, disk plows, cultivators, reapers, and traction engines (for road or plow), also wagons (of German make) have been seen on the quays at Casablanca. These goods are mostly of American, French, or British make. It is probable that the number of farms owned by foreigners in Shawia will continue to increase. With the gradual progress of Morocco, new commercial opportunities will arise and further districts will be opened to trade. The natives of Morocco are very well disposed toward British traders and British goods.

The Future of Rubber in the Far East.

BY CHARLES S. BRADDOCK, JR., PH.G., M.D., LATE CHIEF MEDICAL INSPECTOR ROYAL SIAMESE GOVERNMENT.

Advices from the Far East from Colombo, Penang, and Singapore say that the speculating public there as well as in London has gone mad in the great rubber boom of 1910, on account of the high price of crude rubber. This boom will break as surely as did the South Sea bubble of an earlier century. However, in the future the price of crude rubber will no doubt be lowered to a normal basis, and in a few years will be lower in price than it has been for many years, or may be to a still lower level. The future supply of the world, no matter how much may be the increase of demand, will be supplied almost totally by cultivated plantations and not by the jungles either of Brazil, Africa, or Indo-China. The pendulum of time will swing so that the ruined coffee planters of Java, Sumatra, and the Malay Peninsula return the compliment by ruining the rubber industry of Brazil, as Brazil ruined them in the coffee business, thus evening up matters in the eternal justice of things.

Up to within a few years a great proportion of the coffee crop of the world came from Java, Sumatra, and the Malay Peninsula, until the Brazilian government started its great project of coffee cultivation by subsidizing Italian immigrants, and thus opening up immense areas of coffee country. To-day Brazil controls the coffee markets of the world, and produces annually more than the world can consume. The owners of the ruined coffee plantations in the Far East, with thousands and thousands of acres of improved and cleared jungle, have planted rubber trees between the rows of coffee trees, besides clearing the land over great areas of the primeval jungle, and in the near future will reap the reward of their industry and enterprise. I was informed by a Dutch coffee planter in Java, that of forty-nine coffee estates of which his was one, forty-eight had practically failed and gone out of business as far as active coffee raising was concerned.

One incident of Dutch thrift in this connection came to my notice on the trip home by steamer. Being very ill, I slept on the deck from Bangkok to Suez. At Penang we loaded on great quantities of coffee in bags, which had been shipped from Java and Sumatra for transportation to Europe and America. We arrived at Aden at the mouth of the Red Sea just after dusk of a beautiful tropical night. This port incidentally is a shipping point for Mocha, Arabian, and Abyssinian coffee, which also incidentally brings a higher price than ordinary coffee. As I lay on the deck forward in my steamer chair, I saw that instead of loading coffee at this coffee port, we unloaded it in large quantities, on board of lighters lying alongside the ship. Later in the night the United States consul came on board, going home with his wife, on leave to the United States. On being asked how much coffee arrived at Aden each day, he said about one hundred camel loads, and also now and then an Arab dhow from the African coast brought Abyssinian coffee in, but that great quantities were shipped out, amounting at times to thousands of bags, for which consular invoices were asked, and which was shipped mostly to America. He said he could not understand where so much coffee came from. Pointing over the side at the loaded lighters, I told him that there was his surplus coffee, and that the thrifty Dutch evidently believed in getting as good a price as possible, by unloading it in lighters and transshipping it to the next steamer. Java coffee became Mocha, and the shippers and the consignees had the consular invoices to back them up and show that the coffee actually came from the port from which Mocha coffee is shipped from Arabia; thus to prove the fact to any doubting buyer, who might want to investigate the great supply of Mocha coffee coming from the barren deserts of Arabia.

Now to-day in Brazil the great problem in gathering rubber over the three million square miles of its rubber territory is conveyed in the one word labor; leaving out the great destruction of the wild rubber trees by the careless and unscientific gathering of crude rubber, also often the absolute destruction of the trees. In the Philippines, Indo-China, and the Malay Peninsula the common habit of the native gatherers in the jungle is to cut down the big trees and to scarify the trunk when lying on the ground, thus absolutely destroying the tree; or as the Siamese and natives of Indo-China do in the great valley of the Mekong, cut down and destroy the climbing vine, which there produces some of the finest rubber in the world. To-day, over an area of two hundred thousand square miles in the Mekong valley, the production and export of crude rubber has steadily decreased in the last ten years, and has now almost entirely ceased; Bangkok and Saigon being the two principal shipping ports, and most of the rubber going to France. This area of the Mekong valley is one-fifteenth of that of Brazil.

(*Continued on page 468.*)

HANDCUFFS; AND ESCAPES THEREFROM

BY HEREWARD CARRINGTON

One of the most interesting "acts" in recent years is that of the "handcuff king," who manages to escape in some manner from all sorts of regulation handcuffs, manacles, leg irons, etc. Several of these are placed upon him; and then the performer retires into his small cabinet, and emerges in a few minutes entirely free from all restraint. The cuffs are in every case genuine, and no confederates are employed. It is a very clever illusion.

There are several trick handcuffs upon the market, and, if the performer be allowed to use his own cuffs, they may have been tampered with. There are trick cuffs of various kinds. Some of these simply pull open, and are never properly locked. In some makes, the links of the connecting chain are "faked." In some cases, the lock itself has been tampered with, so that a blow on the hinge serves to release it.

But we will assume that none of these prepared cuffs are used. Those of the committee are employed. If these are of old makes, many of them may be opened with a loop of catgut or shoestring, inserted into the keyhole. This catches the lock, and jerks it back. The style of cuff known as the "German transport chain" is never really unlocked; the hands merely slip the chain, after certain manipulations of the hands and arms. Most padlocks are merely picked with one or other of the numerous skeleton keys, with which the performer is sure to provide himself. French letter locks are opened by finding the proper combination. This is largely a matter of touch, facilitated by placing a wire spring between the arms of the catch, to keep them pressed well back. It would be impossible to describe this feat on paper.

I now come to consider regulation handcuffs and the means of escape therefrom. In this connection it is hardly necessary to describe the various regulation leg irons, since the key which unlocks one make of handcuff will generally unlock the same make of leg iron.

If the performer is not to be searched, his task is comparatively easy. Keys may be concealed in his clothing, in various special pockets, or in the draperies of his cabinet. If, however, he is to be searched, more precautions must be taken. Special keys are then concealed in a false boot heel, in the mouth, in the hair, or in a special false finger which the performer employs, and beneath which the "fake" is hidden. If the key is hidden in the hair, this should be long and bushy, and the performer, after having had his hands examined, remarks to his committee: "Would you like to examine my hair also, and see that it conceals nothing?" As he says this, he passes one of his hands through his hair with a careless motion, and thereby extracts the "fake," which he promptly conceals in one of his hands or elsewhere. A "fake" may also be concealed in the corner of a handkerchief, and in this case an opposite corner can be reached with the teeth. The "fake" being reached in this manner, the performer employs it to open the cuffs as described. There are many contrivances known as "fakes," which are used to open the lock of various handcuffs under conditions when it would be found impossible, even if the performer were in possession of the key, to use it. Mr. Goldstone has introduced an ingenious "fake" of this kind, with which the majority of English regulation cuffs (Figs. 5, 15) can be opened. An illustration is given herewith (Fig. 1). Mr. Goldstone says: "This new 'fake' is nothing more than a steel tube tapered, with a rod fitted through the center. By drawing attention to both ends of this 'fake' it will be seen that they are not level, a quarter of an inch at each end having been filed away. The tube does not contain any thread whatever. To open the irons, thrust the end of the fake into the lock, catch the spiral spring with the longest end of the tube, and then pull outward. It will be found quite an easy matter to open cuffs and irons." It will be seen that this fake is used to force open the spiral spring, which is pulled out by its aid, the usual key opening it being that shown in Fig. 3. Of late a new regulation key has been adopted in England, having the thread on the *outside* instead of the inside. This is shown in Fig. 3. The "fake" which is depicted in the same illustration (Fig. 3) will be found to open almost any cuff having this new improvement; the gradual diminishing size of the thread enabling any cuff to be fitted, the key being simply pushed home until it accommodates the thread of the particular cuff used. It must be borne in mind that handcuffs are of various makes, but that every cuff of a certain make is the same, so that the same regulation key will open all of them. Consequently, the same "fake" may be relied upon to open all of them. This is a valuable piece of knowledge, unknown to the public, which will be found of great use.

HANDCUFF DEVICES AND ACCESSORIES SHOWING THEIR USE IN METHODS OF ESCAPE.

A new and ingenious "fake" has recently been devised, by means of which the majority of regulation handcuffs and leg irons, fitted with powerful springs, can be opened. The method in which this "fake" is employed is depicted in Fig. 2. A key is known as a "master key" when it will unlock two or more handcuffs, padlocks, or any other form of lock. Harry Houdini devised an ingenious master key, with which he was enabled to open almost any regulation handcuff of the English make. It is comprised of a regular key, split on one side, so that it could be forced open more or less to accommodate the size of the thread in the lock presented. Three or four split keys of this variety, of different sizes, fastened together upon a common framework, would enable the performer to escape from almost any English regulation cuff presented to him. A specially long key, and a key having a left-handed thread, should also be included in the performer's outfit. An electric pocket lamp should also be added, as valuable when working in the cabinet, which is generally none too light.

Coming now to consider various makes of handcuffs and release therefrom, it may be well to describe first of all one known as the "Bean handcuff." (Fig. 13.) This is a cuff of American make, and when first patented was considered exceptionally safe. It is exceedingly difficult for the performer to reach the keyhole of these cuffs with the key, when once they have been fastened upon him. Yet in presenting this trick, the performer not only has no duplicate key, but even allows the keyholes to be sealed, thereby showing that no "fake" or duplicate key of any kind is used.

The release in this case is effected by means of an ingenious "fake" depicted in the illustration. (Fig. 4.) This is inserted into the lock, and, being pressed home, forces back the spring catch. The catch being forced back, it can be slipped open almost instantaneously, and the release is effected. This is a favorite cuff, and one frequently employed because of the effect presented in allowing the keyholes to be sealed. This Bean cuff must not be confounded with the "Bean giant," which in many respects is the safest and most perfect cuff ever devised. An illustration of it is given herewith. (Fig. 8.) If this cuff be locked upon the wrists with the keyhole away from the fingers it is impossible to open it, even with the aid of the key. The performer generally produces a decided impression by locking the cuffs upon some member of the committee, giving him the key and asking him to unlock himself. It will be found impossible to do this. (Figs. 7, 11.)

In order to open the cuff, a "fake" may be employed, made as shown in the accompanying illustration. (Fig. 9.) It consists of a long strip of metal, to the end of which a key similar to the original is fastened, though of finer make. When the performer enters his cabinet, he gets possession of this metal strip and, holding the broad end of it between his teeth, he inserts the key into the lock and, by this means, opens the cuffs. If the cuffs are fastened with the keyhole away from the body, the cuffs may be forced on to a key fastened in the woodwork of the stage, in the cabinet, or held in some secure position, and the cuffs are opened by being turned upon the key. Another important point to remember is that these cuffs are not properly locked until the two small knobs above and below the keyhole are pressed well home. If your committeeman does not know this it is poor policy to tell him, as escape from handcuffs is hard work at the best of times, and is usually a race against time.

A very ingenious and complicated cuff, known as the "figure 8" or "plug" 8 handcuff, has been invented. The cuffs having been closed upon the wrists, they are fastened by means of a small screw or plug which is firmly screwed into the lock, retaining the pin, which faces through from the opposite side, as shown in the illustration. (Fig. 10.) In order to open these cuffs, it is necessary to unscrew the plug, then to insert the key, and turning first to the right, then to the left a number of times until the catch be released. An examination of the illustration will make this clear. In order to escape from this cuff, it is necessary, first of all, to unscrew the plug. This may be done by means of a "fake" held in the teeth, or by a more ingenious mechanism of a rather complicated nature, which may be inserted into the plug and, one of its wheels being held between the teeth, the other wheel is turned by means of the tongue, and this serves to unscrew the plug. If the hands be fastened behind the back, a

(*Continued on page 469.*)

A LOCOMOTIVE STAGE

A STRUCTURE THAT WALKS TO ITS WORK

The Piercy locomotive stage, which was invented in 1908, and first used in connection with some difficult marine work at Peterhead, Scotland, is a self-contained movable stage, which takes the place of expensive temporary staging or falsework.

It is built on shore, walks out to its work, and continues to walk as the work advances, standing high above tides and waves and defying the storm. It saves time and money, and is available for many uses besides that for which it was originally designed.

The invention provides a rigid stage, of any desired shape, design, and strength, which rests firmly on the sea or river bed or hard bottom under silt or sand, but can be easily moved, without removing a single bolt or connection, forward, backward, sidewise, or in a curved path. Though so mobile, it is perfectly safe and rigid in all weathers, and is not affected by heavy waves, strong currents, or tides, or even by blasting or other disturbance directly beneath it.

Piercy locomotive stages at Whitby. Note footprints of nearer stage which is "walking."

This result is obtained by supporting the stage on two or more independent groups of spuds, or posts, which can be raised and lowered, and moved horizontally. Normally, when work is proceeding or when the stage is made secure to weather a storm, all of the spuds are lowered until their feet rest on the solid bottom.

When it is required to move the stage, each group of spuds is successively lifted and moved horizontally, while the whole structure rests on the other group or groups of spuds. The horizontal movement of each group of spuds is made possible by the construction of the stage, which consists of two or more parts, which are capable of relative motion in a horizontal, but not in a vertical direction, and therefore support each other in any position. Each of these parts is provided with a number of spuds, which can be raised and lowered. The details of construction, the number, arrangement, and combination of the parts, and the directions in which they can be moved, vary according to the character of the work for which the stage is designed.

With a few rollers, pulleys, ropes, and hand winches, and the necessary timber and bolts, a cheap stage can be constructed on shore, marched out to its position in the water, and subsequently moved from time to time as may be necessary. On the other hand, for large works, where a very heavy and durable plant is required, the most elaborate, mechanically perfect, and well equipped power-driven stages can be constructed, and moved, within reasonable limits, almost as ea[illegible] The machinery required for moving the stage is very simple and is placed on the stage. It may be operated, according to circumstances, by hand, or by steam, compressed air, electric, hydraulic, or other power. The accompanying photographs illustrate the construction and operation of two Piercy locomotive stages, which have been employed in the construction of two breakwater piers at Whitby. The position is very exposed and subject to exceptionally heavy seas, so that very strong and expensive staging was required.

The estimated cost of ordinary timber staging for the two piers, each 500 feet long, was $32,500, while steel staging would have cost $35,000. The two locomotive stages cost $18,000, and it cost about $400 to move them to the work. It is estimated that it will cost $50 to move each stage along its 500 feet of work and $200 to bring back to shore. Allowing $200 for maintenance and repairs, the total cost of the locomotive stages will therefore amount to $19,150, or to $13,350 *less* than the cost of ordinary timber staging.

The stages were arranged to span the foundations of the piers with a clearance of 3 feet and a side travel of 3 feet for the purpose of adjustment. The stride, or distance by which the stages can be advanced by one shift of the spuds, is 10 feet. Each stage has 8 spuds, of which 4 are attached to the corners of an outer frame, 50 feet square, and 4 to the corners of an inner frame, 40 feet square. The steel frames are 33 feet high, extending normally from 3 feet above low water to 22 feet above high water. The spuds have a lift of 21 feet and extend 3 feet below the lower bracings when raised, and 24 feet below these bracings, or 57 feet below the top girders when fully lowered. Hence the top of the stage can, if necessary, be raised 57 feet above hard bottom, or 30 feet above high water, and the load lifted by the crane can be raised 12 feet higher.

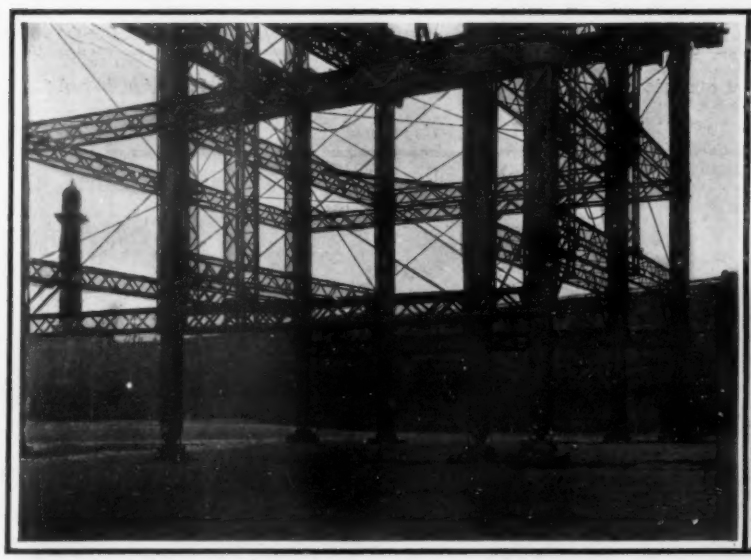
The spuds are Oregon pine timbers, 16 inches square and 37 feet long. Each spud has at the bottom a heavy shoe and at the top a strong socket to receive the end of the steel spud screw. The spud screws are 21 feet long and 5¼ inches in diameter outside the double thread of 1 inch pitch. These screws do not turn, but are moved vertically by brass nuts, 8 inches in length and diameter, keyed in the centers of toothed wheels which are turned by endless screws.

Both stages were erected on shore and "walked" out to the work. The west stage traveled 1,000 feet and the east stage 3,600 feet, yet the transfer of the former cost $325, and that of the latter only $175, because the spuds of the west stage were operated by rope drives from the crane motor, while each spud of the east stage was provided with an independent electric motor of 7½ horse-power, an arrangement which greatly increased the speed of travel. At first, with flat shoes on the spuds, about 3 strides of 10 feet were made per hour. In deeper water, with the shoes removed, the spuds sank from 10 to 18 feet in the sand, and the speed of travel was reduced one-half, but when the crew had become expert and the stage was nearly in position, a stride of 10 feet could be made in 15 minutes. The rate of travel depends almost entirely on the time occupied in lifting and lowering the spuds, as the horizontal movements are effected very quickly.

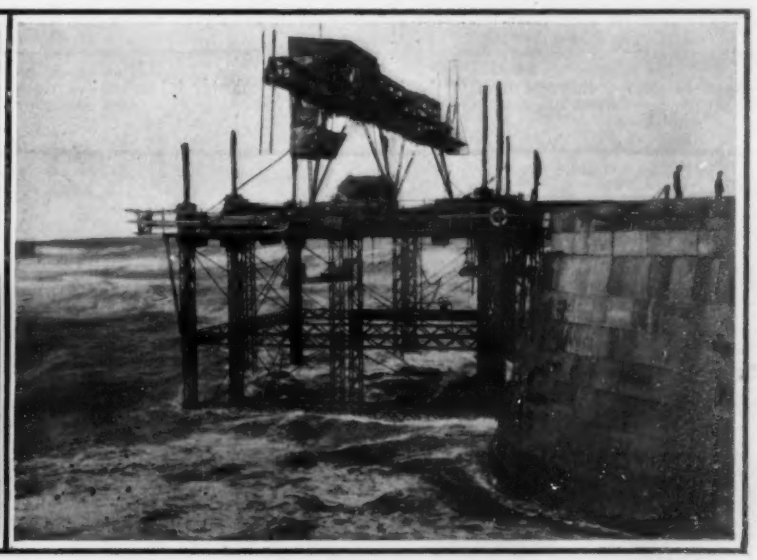
Each stage carries an electric traveling conveyor with a capacity of 6 tons and a range of 100 by 32 feet. This conveyor runs on two sides of the outer frame of the stage. The girders of the other two sides are composed of top and bottom channel plates, 15 inches wide and with 4-inch flanges, connected by struts and braces. In these channels run four pairs of rollers, attached to an intermediate frame, called the rolling frame, which carries no spuds. One roller of each pair runs on the girder and enables the outer frame to support the rolling frame. The other roller runs under the girder and enables the rolling frame to support the outer frame. One pair of rollers is attached to each end of the two main girders of the rolling frame, which, in turn, form the tracks of four pairs of rollers, attached to the inner frame and running on and under these girders.

The relative motion of the inner and rolling frames is perpendicular to the relative motion of the rolling and outer frames, so that the inner and outer frames, with their spuds, can be moved horizontally in any direction, with respect to each other. Furthermore, the whole structure can be supported by either group of

(*Continued on page 470.*)



East stage at Whitby "walking." Note the lifted feet.



West stage at Whitby working in rough sea.

A LOCOMOTIVE STAGE FOR WORK IN HEAVY SURF.

LARGEST CONCRETE OIL RESERVOIRS IN THE WORLD.

BY HAMILTON M. WRIGHT.

The two largest reinforced concrete oil reservoirs in the world are now being rushed to completion at San Luis Obispo, Cal., by the Union Oil Company. Each of the reservoirs is 601 feet inside diameter and 20 feet 4½ inches high above grade. When filled, each of the two huge tanks will hold more than 1,000,000 barrels of oil.

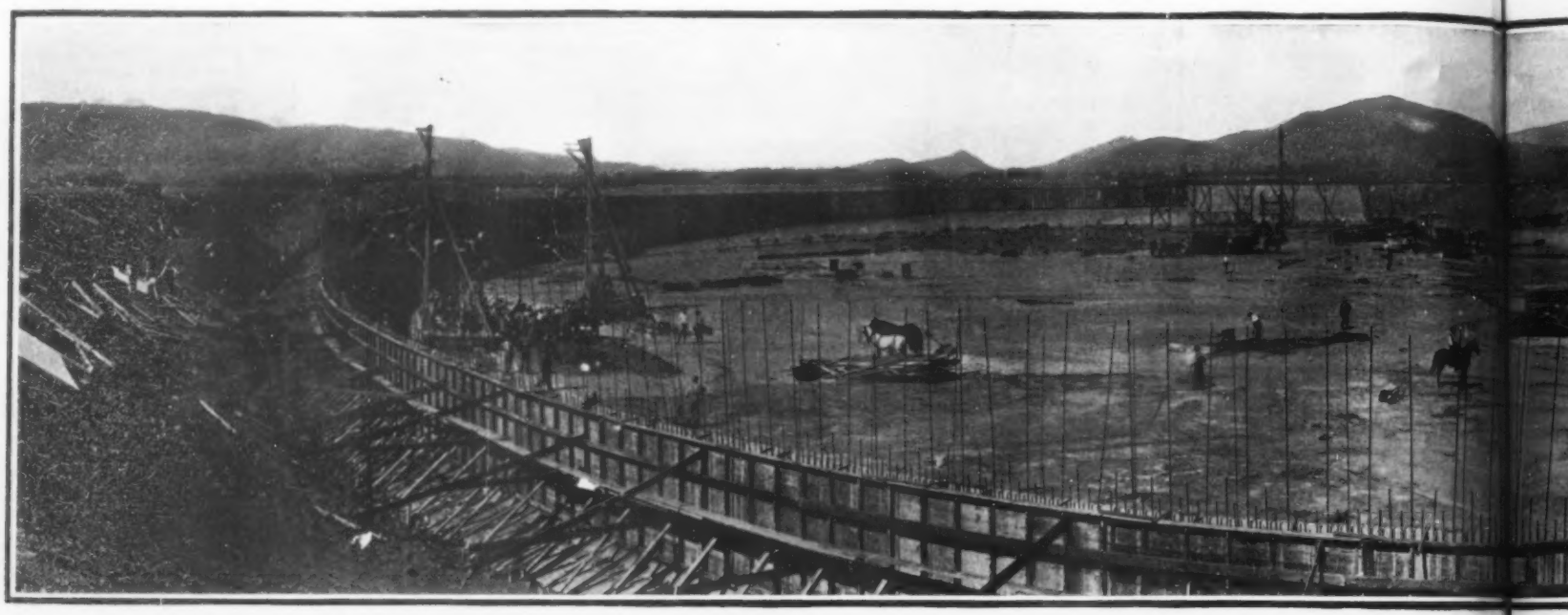
The building of the tanks was started on June 27th, when the Weber-Duller Company broke ground for excavation. The contractors agreed to complete the work by October 28th, 1910, or forfeit $100 per day for each day's delay beyond that time.

The undertaking marks the most important construction work in the California oil fields during the present year. The huge gusher production in the San Joaquin Valley oil fields has rendered an increase of storage facilities the oil industry's most pressing necessity. Millions of barrels of oil are now stored in earth sumps or catch basins, and despite insurance the loss through possible fires or rains would be heavy.

The oil to fill the two concrete reservoirs will be piped to San Luis Obispo through the Producers' Transportation Company's 8-inch pipe line from Bakersfield, Coalinga, Sunset, Maricopa, McKittrick, and the Midway fields. The tanks will cost approximately $250,000 each, making an investment of half a million dollars for these two huge storage systems.

The length of the pipe line which will feed the reservoirs is 200.21 miles besides the gathering systems in the different fields, which add an additional 200 miles to the length of pipe. When the reservoirs are filled with oil the latter will gravitate from the reservoirs to a pumping station to be built at San Luis Obispo, and will be pumped directly from the station to the tank steamers at Port Harford, or at such other points as the Union Oil Company places discharge stations. When filled, the reservoirs may be drained and cleaned by means of a 12-foot by 12-foot by 8-foot sump hole in the center, tapering in the sump hole being at the rate of one to one hundred.

To build the tanks has required a small army of men and the equipment of a regiment. Three hun-

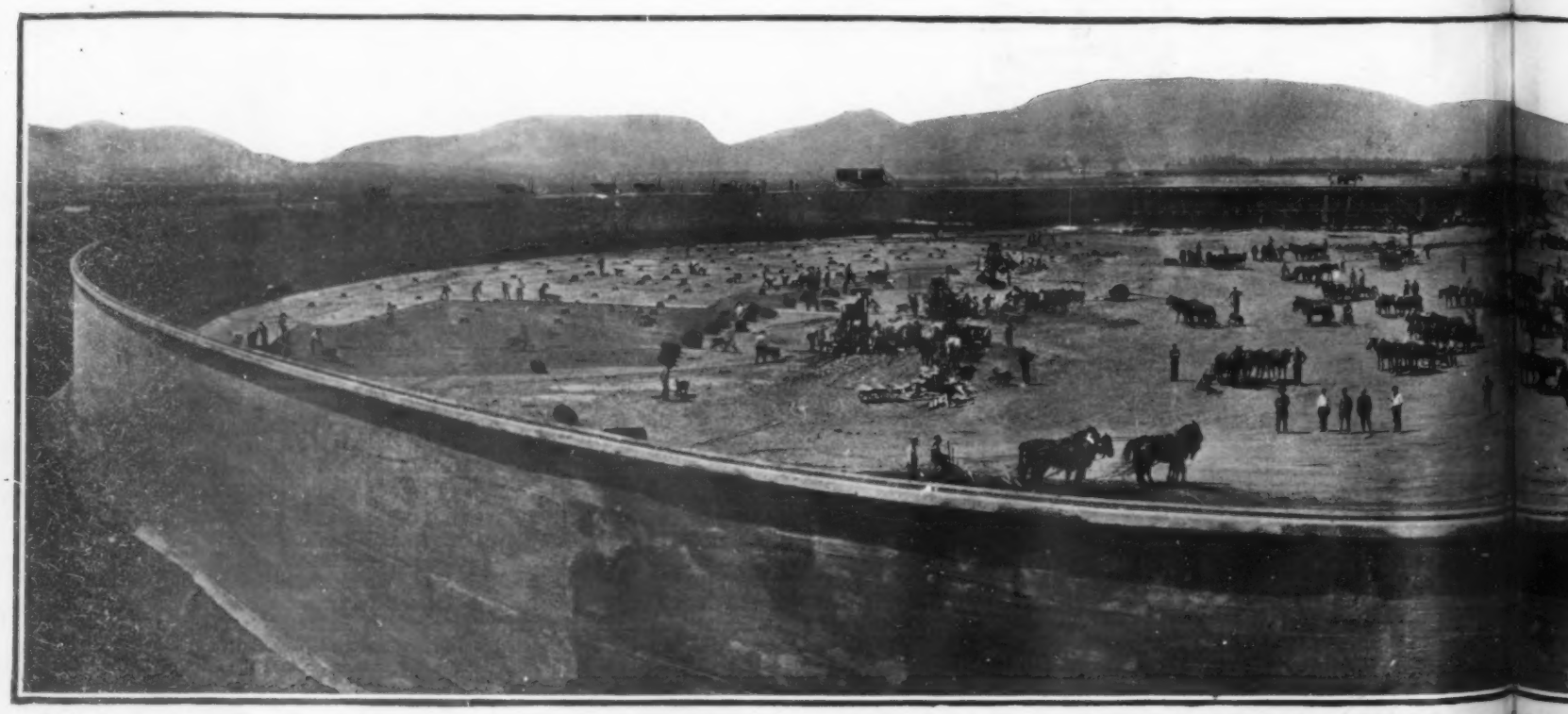


Wall of the huge reservoir, partly constructed, the molds fo

Steel reinforced concrete wall of the 1,000,000 barrel oil reservoir.

Later trimming for walls of concrete oil reservoir.

View of construction work on 1,000,000-barrel oil reservoir.



Constructing the 1,000,000-barrel concrete reser Tank

THE LARGEST CONCRETE O RESE

dred two-horse teams, three hundred teamsters, and about three hundred additional men are employed. Eighty thousand cubic yards of excavation has been done for each reservoir. This dirt is being banked on the outside of the concrete wall with just the roadway between the concrete wall and the dirt. These dirt levees put outside are intended to act as fire walls should a fire sweep toward the reservoirs when filled.

About one million and a half feet of lumber is being used in constructing the roofs and the supports. Twelve thousand cubic yards of concrete placed with four mixers and two hoists is being used in the construction. When both reservoirs are completed the time occupied in actual construction will be about forty days per reservoir.

The walls of the reservoirs stand up in the air 20 feet high without back filling or any other support. They taper from an average thickness of three feet at the base to six inches at the top. The reinforced concrete principle of building walls of city skyscrapers is used, and 250 tons of plain, round steel reinforces the concrete walls. The concrete floor is two and one-half inches thick, reinforced with wire mesh.

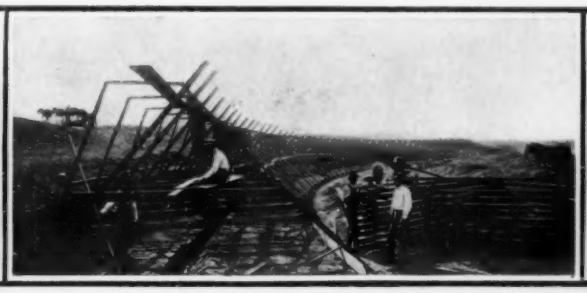
The two tanks are not being built simultaneously. The floor of reservoir No. 1 was finished September 20th, when the mixers were taken to reservoir No. 2.

The building of the two reservoirs follows the necessity of increased oil storage facilities in California, the independent producers of the San Joaquin Valley having recently voted to increase their storage capacity by 15,000,000 barrels. Those independents who have not their oil under contract for a period of years will receive storage certificates which they may negotiate.

With these two huge tanks completed the Producers' Transportation Company and the Union Oil Company will be in position to close contracts for oil delivery to the largest maritime consumers. Delivery to the tanks through the eight-inch pipe line of the Producers' Transportation Company, from the San Joaquin Valley fields will take place at the rate of 25,000 barrels per day. With 2,000,000 barrels of oil in storage and the oil constantly in motion there will never be a time when any considerable number of ships at Port Harford cannot be easily loaded.

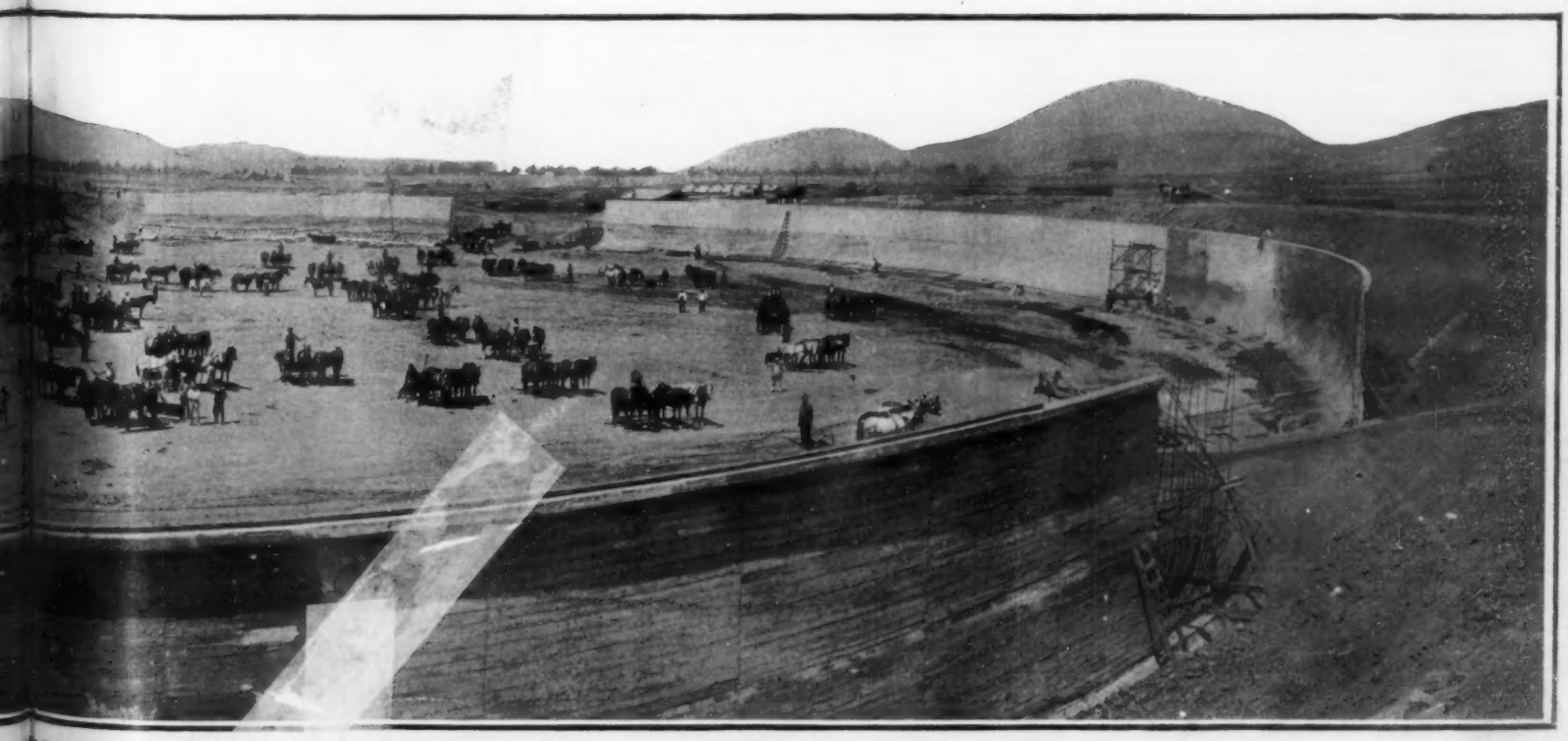
l, the molds for concrete and reinforcing rods of steel.

ting steel reinforced concrete wall 20 feet 4½ inches high for oil reservoir.



Steel reinforcements for walls of concrete oil reservoir.

Trimming for oil reservoir walls.



Tank Farm near San Luis Obispo, California.

RESERVOIR IN THE WORLD.

CURIOSITIES OF SCIENCE AND INVENTION

THE FIRST AEROPLANE EXPRESS.

The first delivery of express matter by aeroplane that has ever been made was that of 10 bolts (500 yards) of silk, which was carried by Phil O. Parmalee on his Wright biplane from Dayton to Columbus, O., on November 7th. The start was made from the Wright aerodrome at Simms Station, near Dayton, at 10:45 A. M., and the distance of 65 miles to the driving park, some 3 miles beyond Columbus, was covered in 63 minutes. The air-line distance from Simms Station to Columbus—62 miles—was covered

THE FIRST AEROPLANE EXPRESS.

in 57 minutes, which was a rate of 65¼ miles an hour, while the 35.9 miles from South Charleston to Columbus were covered in 31 minutes—a rate of 69½ miles an hour. The aviator was favored with a strong northwest wind, which increased his speed over the ground from 40 miles per hour—the normal speed of the Wright biplane—to about 70 miles per hour at times. The 200 pounds of silk, which was valued at $731, was quickly delivered to the home store of the Morehouse Company by automobile immediately after its arrival at the driving park, and thus a striking demonstration of the possibilities of the conjunctive use of the aeroplane and the automobile in the delivery of mail and express was accomplished. The time made was very much less than is required by the ordinary express, as no more direct system of town to town delivery could be devised. The weight of the aeroplane complete, with silk and aviator, was 1,180 pounds, and during part of the journey Parmalee drove his machine to a height of 2,500 feet.

AN AMPHIBIOUS AUTOMOBILE.

Some time ago we described in the Scientific American an automobile which had borrowed from the aeroplane a new method of propulsion. The driving wheels were disconnected from the engine, and the motor was connected instead to an aeroplane propeller located at the rear of the machine. With this novel driving mechanism the automobile fanned itself along at a high rate of speed, and in a race with an aeroplane, succeeded in making a speed of a mile a minute. This same machine has since been used in another novel manner. It was mounted on a small float on the White River, Indianapolis. Wires connected the front wheels with the rudder of the boat, so that the craft could be steered by operating the steering wheel. With this simple arrangement, the craft was propelled at a high speed, beating all launches on the river. Owing to the fact that the thrust of the propeller was considerably above the drag of the boat,

ODD COMBINATION OF WATER, LAND, AND AIR MACHINE.

there was a tendency, at high speed, to force the boat downward, and the danger of sinking prevented the use of maximum power. With the propeller revolving at 600 revolutions per minute, the float sank until the gunwales were almost level with the water. To persons on shore, the automobile appeared to be skimming over the surface with no float beneath it.

BLACK LIGHTNING.

Amateurs who take the trouble to photograph discharges of lightning are sometimes astonished to find that some of the flashes show black instead of white. Two excellent examples of such "black lightning" are published herewith. They have been selected from a collection photographed by Mr. Franklin Henshaw at Little Rock, Ark., this summer. Fig. 1 shows a broad white streak of light with a number of black branches radiating from it. At one or two places, in the original, there appears to be the trace of a heavy black streak peeping out from under the edge of the white streak, as if the white streak were covering a black one. This discharge struck a building seven blocks away from the photographer. The other photograph is a two-minute exposure, during which time there were several lightning discharges. One of them is perfectly white, the other white with a black border at each side, and still a third that is entirely black. The black-bordered flash has the appearance of having exploded in the air. The explanation of these dark flashes is that they were reversed by over-exposure. They were probably more feeble than the other flashes, and were taken first. As the plate remained exposed for the other and more brilliant flashes, a reversal took place on the negative, due to over-exposure. This same effect has been produced experimentally by exposing a plate to an electric spark in a dark room, and then exposing the plate a second time to gaslight.

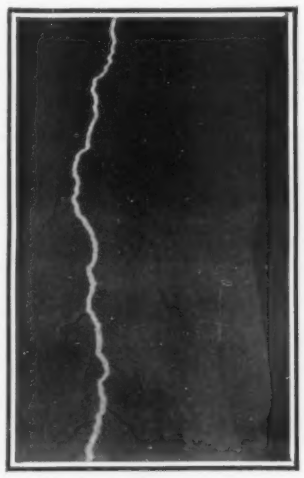


Fig. 1.—LARGE WHITE FLASH WITH BLACK BRANCHES.

Fig. 2.—A BLACK FLASH AND A BLACK-BORDERED WHITE FLASH.

SIGNALS FOR AVIATORS.

Kipling, in his famous "Night Mail," speaks of lighthouses which guide his imaginary air vessels to safety. Perhaps the German Aerial Navy League was inspired

SIGNAL NUMBERS FOR AVIATORS.

by his story when it proposed that special beacon lights be erected at certain points. The aviator of the future will certainly need some such guidance if he flies by night. He will also need something to guide him by day. Attempts have already been made in Germany, through the efforts of Dr. von Oechelhaueser, to provide signals. In his system countries and provinces are designated by serial numbers, and towns by combinations of two letters. The tops of gas tanks, which are painted black, are especially suitable backgrounds for the large white characters of the signals. One gas tank at Dessau, in Anhalt, has been marked with the serial number of the province, 75, in figures 33 feet high, and another with the name Dessau in letters 13 feet high, with an initial capital letter 20 feet high. This name has been read distinctly, in not very clear weather, from a balloon at an elevation of 1,300 feet.

A somewhat similar plan was recently proposed by Réné Quinton, of the National Aerial League of France. As shown in the accompanying illustration, his scheme consists in using numbers, each indicating the aviator's distance from Paris, and his position relative to that city. The figures are to be placed on the ground, or on a suitable roof, and will always read from west to east. The first number indicates the distance north or south of the parallel of Paris, and the second the distance east or west of the meridian of Paris. Six figures at the most will be required. Often five, and even four, will cover most points in France. Experiments have been made to test the scheme from the Eiffel Tower, with such success that it is said the road between Issy-les-Moulineaux and Châlons is to be thus mapped out for a breadth of five miles, this being the most traveled airway of France.

NEW METHOD OF HANDLING THE WOUNDED ON WARSHIPS.

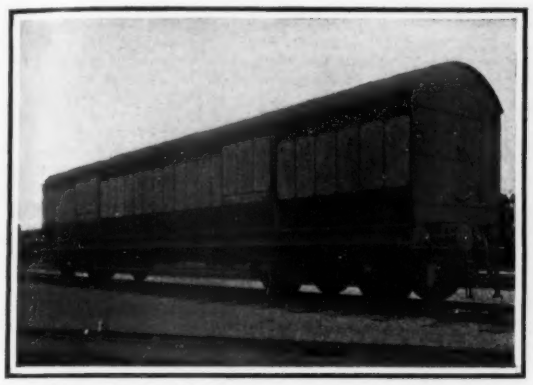
Ordinarily the injured in a naval battle must be carried to the hospital quarters on stretchers as are the wounded in a land battle. In the latter case conditions have been improved by the use of ambulances where the field hospital is at some distance from the firing line. Probably because in war vessels the hospital quarters are so near the region where the actual fighting takes place, no special provision has heretofore been made to facilitate the handling of the wounded. It is a simple matter to carry the disabled man on a stretcher until one comes to the hatchways. It is impossible to carry a man down a narrow stairway without subjecting him to lurching and jogging motions that may be extremely painful. As a remedy for this evil the German navy has introduced a new method of conveying the injured to the sick-bay. A canvas jacket or bag is wrapped about the wounded man and laced up snugly. The bag is provided with handles whereby it may be attached to a hoist and by which it may be lowered to the hospital quarters. This method has the advantage of being expeditious and quite painless as well.

LOWERING A WOUNDED MAN TO THE HOSPITAL QUARTERS.

AN AEROPLANE FREIGHT CAR.

The accompanying illustrations show the exterior and interior of a new freight car which has just been brought out in England for the transportation of aeroplanes (especially those of the monoplane type) from one part of the country to another. The car is provided with end doors which make it possible to load a monoplane, after the wings have been detached,

by running the body part of the machine in at one end. The wings can then be placed on edge against the sides of the car. Suitable straps (which can be seen in the interior view) are provided for holding the wings in place against each side of the car. The car is provided with a rounded roof in order to make it conform as closely as possible to the loading gage of the railroad, and thus to gain every inch of available space in height as well as width. It is expected that a number of cars of this type will be needed in order to fulfill the demands of the aviators for transporting their machines quickly from point to point when aviation meets are in progress throughout the United Kingdom.



EXTERIOR OF AEROPLANE CAR, SHOWING END DOOR CLOSED.

INTERIOR OF AEROPLANE CAR, SHOWING END AND SIDE DOORS OPEN.

UNIQUE WATER BICYCLE.

BY A. W. CUTLER.

A curious foot-power craft has made its appearance in the waters about New York, which, for lack of a better name, might be called a "water bicycle." It comprises three boat-shaped floats which support an iron framework similar to that of a bicycle. These little floats are made of light cedar wood, and are hollow. The construction of the machine admits of their being turned up on end and cleaned, or emptied of any water that may have leaked in. The gear is like that of a bicycle and is connected by a universal joint, to a shaft which carries a small screw propeller located between the two rear floats. The entire machine weighs but seventy-five pounds.

In the great water parade at the Hudson-Fulton celebration, the inventor, John Mitchell, pedaled his curious little craft up the river between the "Clermont" and the "Half Moon." Mr. Mitchell has propelled the water bicycle up the Hudson as far as Yonkers, down the bay to Coney Island, and up the Shrewsbury River. His most hazardous trip, however, was one around the Battery, up the East River, and through Hellgate, to the Sound.

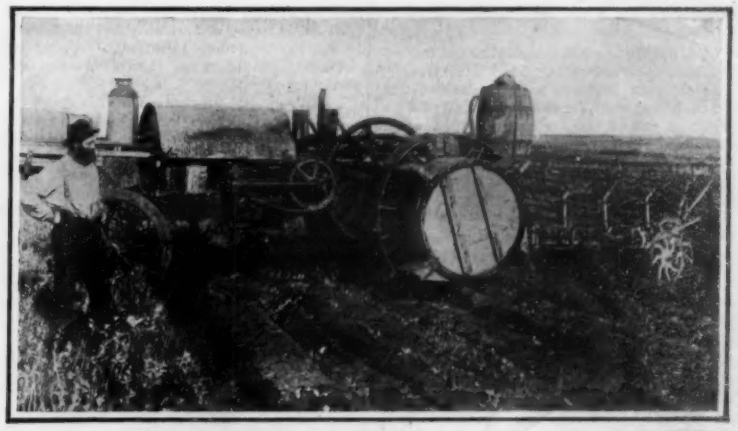
PEDALING UP THE HUDSON.

CLEANING THE FLOATS OF THE WATER BICYCLE.

A HOME-BUILT TRACTION ENGINE.

An ingenious farmer at Spy Hill, Saskatchewan, has rigged up an engine which he uses for traction purposes, and also for various power purposes about the farm. Living, as he does, away up in the north country, where towns are few and far between, this man, Mr. Scheil, has been obliged to depend upon his own resourcefulness and a natural mechanical bent to assist him in the construction of the machine. He bought a marine engine of 10 horse-power, and adapted this motor to do the work of a stationary engine. The engine was mounted on the base of an old steam traction engine. This improvised traction machine serves to draw his plows, seed drills, and harrows. Three plows, each turning an average of about a fifteen-inch furrow, a four-inch disk seed drill, and a two-section toothed harrow, are hauled by the traction engine. Therefore, with this outfit, he performs the complete operation of plowing, planting his seed, and harrowing. Of course, with work of this kind, it is necessary to provide the engine with some sort of governor. The governor was rigged up on the premises, and has proved to be very sensitive. It controls the throttle, and does not permit the engine to vary in speed. A spring is placed on the slip governor, so that if the pull should happen to be too much, it would let go of the load as the speed decreases, and likewise when starting. As soon as the engine speeds up to an average of 350 revolutions per minute, the load is put on automatically. The outfit has proved to be very successful. It runs at a speed of from three-quarters to one and a half miles per hour, and can work about two acres of ground per day. The engine starts with the plow in the ground without any difficulty, unless the sod is exceptionally tough, but even under such conditions the engine pulls out its load after a little coaxing.

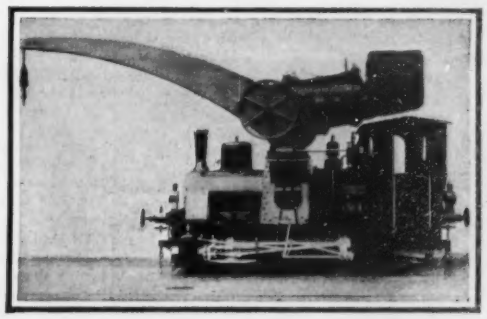
THE MARINE ENGINE MOUNTED ON THE BASE OF A TRACTION ENGINE.



THE IMPROVISED TRACTION ENGINE AT WORK IN THE FIELDS.

COMBINED LOCOMOTIVE AND CRANE.

There is nothing very novel in the combination of a locomotive and crane. The most familiar combination of this sort is the wrecking engine, which is a powerful crane self-transportable to the scene of the wreck, and able to haul the cars necessary for bringing back the wreckage to the repair shops. Another common form of transportable crane is the type used in docking yards and the shipping yards of large manufacturing concerns. The accompanying illustration, however, shows a very unique form of crane combined with a locomotive, which is of German design. It consists of a switching locomotive fitted with a saddle frame, on which is mounted a crane of the balanced or hammer type. This form of crane is not powerful enough for wrecking purposes, but is useful in freight yards where the locomotive may be employed in shifting cars and making up trains, while the crane may be employed in hoisting freight to and from the cars. The crane is provided with a swivel mounting and is also capable of swinging through a small angle vertically. The advantage of this construction lies in the fact that the crane may be applied to an existing locomotive and hence is more economical than other constructions in which the locomotive is designed and built especially for the purpose.



PECULIAR CRANE AND LOCOMOTIVE.

At a recent meeting of the Transvaal Institute of Mechanical Engineers, the president referred to the steel industry which will shortly be started by the South African Steel Corporation, the Héroult electric furnace being used for the conversion of miscellaneous scrap into steel. He expressed the hope that this effort at local production would not meet with obstacles in the way of suspicion and prejudice. "It is true," he proceeded, "that the total output of the South African Steel Corporation will be for a time dependent on the amount of convertible scrap available, but it will be in the interests of the company, and, indeed, the terms of its contract with the government compel it, to spend a certain proportion of profits in experimenting on the reduction of our native iron ores. It is quite within the bounds of possibility that a true steel industry will be established in a few years' time, having as its bases, first, the enormous iron ore deposits in the country, and, secondly, the low-priced electric power that cheap coal and more economical methods of transforming it into power will render possible."

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

HAT.—S. Newman, Cincinnati, Ohio. This invention comprehends a hat, the crown of which is slightly swelled for the purpose of avoiding pressure upon adjoining portions of the wearer's head, and to the provision of means for holding the sweat band gently against the wearer's head at the points in question but with a degree of pressure much gentler than that otherwise afforded by the hat.

COLLAR.—Clara Kahn, New York, N. Y. This invention is an improvement in collars, and has in view a stiff shirt or waist collar for either ladies or gentlemen, which can be washed with less work or at least expense and take up less room than the conventional linen collar, yet present a collar with a linen or washable fabric facing.

Electrical Devices.

THERMOSTAT.—R. H. Waite, Denver, Colo. An object of the inventor is to provide a thermostat which may be used to close a circuit at high temperature, as in case of fire, and thus sound an alarm or close a circuit at a predetermined low temperature. In the latter case the device may be used to sound an alarm if crops are in danger of frost or to operate devices for starting smudge fires.

TROLLEY-WHEEL.—E. K. Harris, Canandaigua, N. Y. The special features of this wheel are such that a greater portion of the wheel touches the trolley wire than in ordinary metal trolley wheels, and the wheel is formed of such material as to allow the wire to give a uniform contact irrespective of irregularities or projections along the length of the wire.

Of Interest to Farmers.

FRUIT CLEANER AND GRADER.—I. W. Peck, Bradentown, Fla. The object of this improvement is to provide a device that will grade or sort the fruit into classes, according to size, and will afterward clean the assorted grades, each grade being cleaned by a device adapted especially for that size.

LOADER AND STACKER.—R. B. Fulton, Red Cloud, Neb. This machine is capable of performing efficiently the work of a number of machines heretofore employed for different though allied purposes. It thus serves not only as a loader and stacker, but also as a hay sweep. It may be used as a manure or snow shovel, for loading baled hay or ear corn, and many purposes involving elevation and transportation of material.

BEEHIVE ATTACHMENT.—S. Blagg, Erie, Ill. It is the object of the present invention to provide an improved means for raising or detaching the super from the body and removing it without seriously disturbing the bees and without danger to the operator. It is an improvement on a former Letters Patent of the U. S., granted to Mr. Blagg.

Of General Interest.

SHEET-METAL PIPE.—H. Birnbaum, Rapid City, S. D. This pipe-section is adapted to serve as a stovepipe or various other uses, and is so constructed that it may be enlarged or contracted in diameter to accommodate and receive other sections differing in size, and the aggregate length of two or more sections thus coupled may be increased or reduced by sliding one upon the other, telescopically.

DRIP-CUP FOR UMBRELLAS.—J. T. Bluff, Butte, Mont. The cup can be collapsed when not in use and offers no material obstruction upon the staff of an umbrella and can be quickly adjusted to receive the drip from a wet umbrella and easily emptied and readjusted to receive drippings or to be collapsed.

RECEPTACLE FOR SPUTUM.—W. L. Gerard, Bellingham, Wash. This device embodies a supporting frame, a removable receptacle hung in the frame, sheets of paper pendent in the frame and receptacle or sides thereof, means whereby paper from a roll may be drawn into position for covering soiled sheets, by the invalid or the nurse who may remove the paper and receptacle from time to time and cleanse the latter for replacement in the frame.

GYROSCOPE AND SPHERE.—J. F. O'Byrne, Contact, Nev. This invention relates to tops and more particularly to the gyroscope top and is a combination of this well known toy and an ordinary hollow sphere which in the invention is regarded as the earth. Besides providing an amusing toy, the object is to explain and illustrate to the child the motion of the earth around the sun, giving the seasons, and its rotation on its own axis, giving the days and nights.

Hardware and Tools.

RAZOR-STROPPING DEVICE.—W. H. Shattuck, Bridgewater Corners, Vt. The aim in this case is to provide a device which may be operated on the ordinary strop, the razor blade holder being pivoted to pins secured to a roller which travels on the strop, by which means the razor blade holder is moved to the other side by the roller, when the movement is reversed.

Heating and Lighting.

FIRE-KINDLER.—S. Ishii, Roslyn, N. Y. This invention relates to fire kindlers, the more particular purpose being to provide a kindler of this kind having suitable form for attachment to gas fixtures, and provided with apertures through which the gas can escape into and around the fuel in order to facilitate the ignition of the same.

JEWELER'S AND DENTIST'S BURNER.—A. Zarembowits and C. Zarembowits, New York, N. Y. This invention has reference to a burner to be used in the workshop of jewelers and dentists, or in any other profession where an easily adjusted flame is desired. The burner may be quickly and readily adjusted to give any one of a number of different flames, as desired, and has means for holding the parts in adjusted position.

Machines and Mechanical Devices.

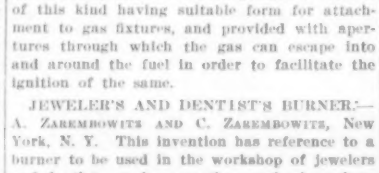
BELLY-ROLLING MACHINE.—E. R. Zehner, Toledo, Ohio. This machine rolls the bellies of pigs to make the meat firm and compact and to give it a better appearance, all of which is effected by an endless belly carrier. A meat flattening roll co-operates with the carrier and is movable therefrom in pressing or flattening operation whereby to subject the belly to a uniform pressure, and means provide for driving the roll and means operatively connect with the driving means to maintain the elements of the latter in working engagement on any position of the flattening roll.

BENDING MACHINE.—E. T. Palmenberg, New York, N. Y. This machine is more especially designed for forming hooks on the supporting rods of garment hangers and arranged to permit a number of such rods to be acted upon simultaneously, with a view to form hooks of uniform size and shape, and irrespective of whether the rods under treatment at the time are attached to the hangers or not.

ROLLING-BALLS GRINDING-MILL.—L. Hoffmann, Vienna, Austria. The material introduced on falling down first is encountered by the beating wings and thus broken and thrown against the stationary grinding surface. By action of the helical surfaces on the upper side of the revolving ball disk, the balls are not only thrown outward, but also upward and strike against each other and against the stationary grinding surface, thus comminuting very efficiently the material which they encounter and then fall again on the ball disk and so on.

CYLINDER-MOUNTING FOR CARRIAGE-FEEDS.—C. P. Myer, Houston, Texas. This invention pertains to mountings for carriage feeds for use with saw-mills and the like, and has reference more particularly to a cylinder mounting in which the steam or other fluid pressure cylinder, having a piston therein and a rod operatively connected with the carriage, is adjustable to equalize the wear resulting from the sagging of the piston rod.

METHOD OF SEAMING CAN HEADS TO CAN BODIES.—J. Hoiland and K. J. Halleland, care of Rosenstein Brothers, 98 North Moore Street, New York. The invention relates especially to cans which are to contain preserved food, and which it is desirable to



METHOD OF SEAMING CAN HEADS TO CAN BODIES.

seam without the use of solder, but so that the cover may be stripped from the body easily when the can is to be opened. Both the can body and can head are formed with edge flanges that may freely move one within the other. The flanges are then doubled and jammed together to complete the seam.

SEWING-MACHINE ATTACHMENT.—J. O. Ostman, Hancock, Mich. The aim in this instance is to provide an attachment for preventing reverse motion in sewing machines which may be applied to existing machines without material changes, and which when the machine is not in the actual operation of sewing will not affect the operation thereof in any manner.

PUMP.—C. M. Smith, Los Angeles, Cal. The principal objects here are to provide a pump which may be operated as a single acting or as a double acting pump; to provide a pump which may be operated by man, horse, or engine power at will; to provide one wherein the flow is even and continuous without pulsation or break; and to provide a plunger lead whereby there is no suspension of the lifting action.

CENTRIFUGAL PUMP.—G. E. Hanes and J. B. Waller, Kansas City, Mo. This pump will raise a large volume of water from a comparatively deep well without requiring a foot valve, and operate effectively with the expenditure of a minimum of power. Means are provided which will enable an adjustment of parts to decrease the lifting power thereof, and a corresponding decrease of power employed in operating the same.

CLUTCH.—H. W. Lloyd, 1805 East Beaver Street, Jacksonville, Fla. The object of this clutch is not only to transmit motion from a driving to a driven shaft, but to vary the speed of transmission without intermeshing gears and without any break or interruption in changing from one speed to another. The clutch is provided with a chamber, in which a liquid is confined, and the liquid is circulated when the driven member rotates at a lower speed than the driving member. By controlling the rate of flow of the liquid the relative speed may be varied at will.

MACHINE FOR MILLING SLICING-KNIVES.—V. E. Dobbs, No. 12 Akazienstrasse, Kothen, Anhalt, Germany. The present invention has reference to an improved machine for use in milling the grooves in slicing knives such as beet slicing knives and in particular on what are called roof ridge knives, that is to say knives in which their continuous ribs are formed on the ridges separating the separate grooves one from the other.

Pertaining to Recreation.

FISH-HOOK.—J. Y. Payton, Waldron, Ark. This inventor provides a hook which will move forward into the mouth of the fish when the latter is taking the bait, and hence will be more liable to engage the fish than will the ordinary hook. An operative mechanism is provided to accomplish this result, the mechanism being incased in a short protecting tube and guard and not liable to be broken by catching on weeds, rocks or projections.

ARTIFICIAL BAIT.—E. L. Cox, Alamosa, Colo. The bait is in form of a buoyant body, practically indestructible and has the shining surface of the natural insect or minnow. The body of the bait is covered with a quill and the quill is bound about the ends of the body to keep out the water, the body or inner surface of the quill being perfectly colored to imitate the insect or other bait which it is supposed to represent.

Railways and Their Accessories.

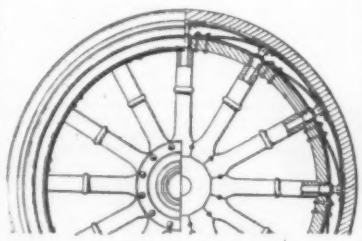
METALLIC RAIL-FASTENER.—Letitia Leaf, Findlay, Ohio. The purpose here is to deaden shock and vibration incident to the wheels of the rolling stock by interposing between the metallic supporting block and tie a block of wood or other suitable material, the wooden block being preferable, let into a groove formed in the upper face of the block and extending lengthwise of the rail, and the angular spike openings being partly formed in the block, which prevents the spikes from becoming loose by expansion and contraction of the metal.

PORTABLE TRAMWAY.—O. F. Heydenreich, New Orleans, La. Among the principal objects which the present invention has in view are: to provide a mechanism whereby the operation of the tramway is simplified and facilitated; and to provide a mechanism for operating the carrier to automatically arrest the same in adjusted positions.

CONCRETE RAILWAY-TIE.—R. J. D. Cowan, Greenville, Mo. This invention furnishes a novel construction of tie and the clamps or yokes for securing the cushioning rail seats permit of the cushions being fitted loosely therein, thereby providing for expansion of rail and allowing the vibrating motion desirable for the preservation of the rolling stock. The plates are embedded with no parts exposed thereby prolonging the life of the tie.

Pertaining to Vehicles.

SPRING WHEEL.—James A. Wible, Oakdale, Pa. With a view to overcoming tire troubles on automobiles, Mr. Wible has designed a wheel within a wheel, that is, a wheel with a separate rim, the outer rim bearing a solid tire, being connected to the inner rim by



SPRING WHEEL.

means of leaf springs. In order to keep one rim from creeping with respect to the other, the spokes of the wheel are made hollow, and are fitted with plungers connected to the outer rim. A coil spring pressing against the inner end of the plunger assists in giving the necessary resiliency.

SHAFT-DRIVEN AXLE FOR AUTOMOBILE VEHICLES.—F. Pilain, 17 Chemin de Monplaisir, à Grange-Rouge, Lyon, France. This invention relates to a system of shaft driven axle for automobile vehicles. This axle comprises a carrier-axle body with hollow barrels allowing the passage of Cardan-shafts coming from the differential which receives the drive from the engine in any convenient manner, and is mounted in a box of casing fixed to the chassis or frame of the vehicle, the shafts entering freely within the barrels and driving outside their central planes the wheels mounted upon the barrels.

SADDLE-SUPPORT.—E. H. Pinkham, New York, N. Y. In this invention the improvement is on cycle saddle supports, more especially for motor cycles, and the inventor has in view a yielding support with which the saddle moves rearwardly and is depressed at both the front and the rear under shock, and is returned forwardly and raised by the recoil to normal position.

MOUNTING FOR MOTOR-CYCLE SADDLE.—S. Busch, New York, N. Y. Among the principal objects in view in this case are: To provide means for adjusting a saddle to the various positions desired for riding; to provide a construction and an arrangement of springs which form a sensitive and graduated cushion, and provide a construction which is strong and durable.

VALVE.—G. Schuster, Beszterecze, Austria-Hungary. In the present patent the invention is an improvement in valves for pneumatic vehicle tires, cushions and other air-inflated articles, and it has for its purpose the prevention of possible leaking of the air through the valve after the article has been inflated.

SPRING-TIRE.—V. A. Marsh, Endicott, Wash. This inventor provides a spring cushion for ties to yield to inequalities of the roadbed while preserving the circular shape of the tire; provides a cushion having a series of communicating separate spring members arranged to yield individually and to transfer a proportion of the compression strain; provides means for excluding dust and grit from access to working members; and provides a wearing shoe constructed from material adapted to grip the road bed.

VEHICLE-WHEEL.—O. Treier, New York, N. Y. The purpose of the present invention is to provide a new and improved vehicle wheel, more especially designed for use on automobiles, bicycles and other vehicles, and arranged to readily yield and to cushion the vehicle. The wheel can be readily and conveniently repaired whenever necessary.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Legal Notices

60 YEARS' EXPERIENCE
PATENTS
TRADE MARKS
DESIGNS
COPYRIGHTS &c.

INVENTORS are invited to communicate with Munn & Co., 361 Broadway, New York, or 625 F Street, Washington, D. C., in regard to securing valid patent protection for their inventions. Trade-Marks and Copyrights registered. Design Patents and Foreign Patents secured.

A Free Opinion as to the probable patentability of an invention will be readily given to any inventor furnishing us with a model or sketch and a brief description of the device in question. All communications are strictly confidential. Our Hand-Book on Patents will be sent free on request.

Ours is the Oldest agency for securing patents; it was established over sixty-five years ago.

MUNN & CO., 361 Broadway, New York
Branch Office, 625 F St., Washington, D. C.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending November 29, 1910,

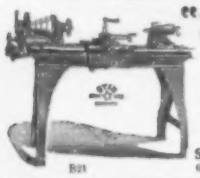
AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Abdominal supporter and catamenial sack, combined, R. H. & M. L. Keagy	976,883
Acid, amid of *B-B* -diethylpropionic, L. Taub	977,053
Adding and subtracting machine, W. Schooling	977,333
Aeroplane, L. A. Hagel	976,876
Air and producing ozone, means for filtering, S. C. Shaffner	977,335
Air and producing ozone, means for filtering, Shaffner & Hutton	977,336
Air brake, duplex pressure straight, C. P. Cass	977,164
Air heating, Westinghouse & Gow	976,966
Air heating apparatus, Westinghouse & Gow	976,967
Airship, T. S. Harris	976,873
Alarm. See Sprinkler alarm.	
Alarm system, central energy electrical temperature, Goldstein & Pool	977,290
Alarm system, electrical thermostatic, A. Goldstein	977,295
Amusement apparatus, W. W. McFarland	976,896
Anchor bolt, lead packed, G. E. Rohmer	977,402
Annunciating apparatus, electric, H. J. Aither	976,836
Apple grading machine, G. L. Bedker	977,305
Arch support, W. R. Lee	976,888
Auto organ, J. R. England	977,094
Automatic lubricator, F. Riegrose	976,922
Automobile signaling device, W. G. Nash	977,245

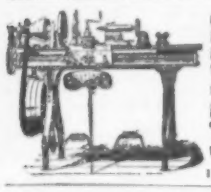
A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since October 4th, 1859, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.



"Star" Lathes
Large line of Attachments
For Foot or Power
Suitable for fine accurate work in the repair shop, garage, tool room and machine shop.
Send for Catalogue B
B21
SENECA FALLS MFG. CO.
695 Water St., Seneca Falls, N.Y.

THE SEBASTIAN 15-INCH ENGINE LATHE
HIGH GRADE LOW PRICE
Automobile Builders, Garages, Repair and General Jobbing Shops find this the ideal lathe for their work. Catalog free.
The Sebastian Lathe Co., 120 Culvert St., Cincinnati, Ohio



FOR GUNSMITHS, TOOL MAKERS, EXPERIMENTAL & REPAIR WORK, ETC.
From 9-in. to 13-in. swing. Arranged for Steam or Foot Power, Velocipede or Stand-up Treadle.
Send for Lathe Catalog.
W. F. & JNO. BARNES CO.
Established 1872.
1999 Ruby St., Rockford, Ills.

A Desirable Holiday Gift
DRAPER'S
Recording Thermometer
Traces automatically a correct and continuous record in ink of the temperature on a graduated weekly chart. Made in two sizes, and standardized and fully guaranteed. Also other recording weather instruments.
Size 9 x 14 ins., Price, $20
Size 14 x 20 ins., Price, $25
THE DRAPER MFG. CO.
152 Front St., New York

Pumps Water by Water Pressure
For supplying running water in country houses, summer hotels and for irrigation purposes on farms, &
NIAGARA HYDRAULIC RAM
is the ideal system. Pumps water without cost. Write for catalogue AA and estimate.
NIAGARA HYDRAULIC ENGINE CO.
1440 Nassau St., N. Y. Factory: Chester, Pa.

Nulite Gasoline Table Lamp
A beautiful lamp for homes, hotels, offices, stores, banks, cafes. Portable, safe; can be turned upside down or rolled on the floor without danger of affecting the light. 300 C. P. of soft, brilliant light, one-third cent per hour. Also 200 different styles of lamps and systems.
AGENTS—We want town, county, and traveling salesmen. Best proposition ever offered. Sells everywhere. Write for Special Offer.
CHICAGO SOLAR LIGHT CO.
212 So. Jefferson Street CHICAGO

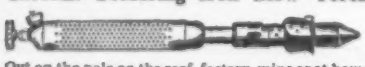
TYPEWRITERS ALL MAKES

Visible Writers or otherwise
Olivers, Remingtons, Smiths, etc.
Shipped ANYWHERE for Free Trial, or RENTED, allowing RENT to APPLY.
Prices $15.00 up
First class Machines *fresh from the Manufacturers*
Write for Illustrated Catalog 10. *Your opportunity.*
TYPEWRITER EMPORIUM (Est. 1892), 92-94 Lake St., Chicago.

I Made $15 a Day
Selling Metallic Signs
What this man did you can do. Easy money. Everybody buys quick. Best letters ever made for signs on store fronts, office windows, house numbers, etc.; resemble finest gold leaf. Letters all ready to put on. Put up a complete sign in a few minutes. Big demand everywhere. A gold mine for agents. Great side-line for travelling men. Write to-day for free sample of letters and bona fide testimonials from those who have made big money. Make more easy money than you ever made before.
METALLIC SIGN LETTER CO., 430 N. Clark St., Chicago

4 H.P. STATIONARY GASOLINE ENGINE '76
12 H.P. $219
For Farmwork, Irrigation or Pumping, Factory use and Electric Lighting.
3 to 20 h. p.—perfectly governed-guaranteed by a responsible firm. Write for particulars.
GRAY MOTOR CO. 121 Leib St., DETROIT, MICH.

Gasoline Soldering Iron Blow Torch



Out on the pole on the roof, factory, mine or at home it fills the bill. Our booklet on request.
EMMELMANN BROS. MFG. CO.
INDIANAPOLIS, IND., U. S. A.

18 TOOLS IN ONE PAIR of Scissors
Here is the most wonderful pair of scissors you ever saw or heard of. In complete and perfect tools, the greatest convenience in the home, office, camp, traveling, or anywhere. Actual size 6½ inches long. This gives you an entire tool chest for the pocket. Thousands of these scissors have been sold for $1. We bought a big lot and sell them with elegant leather case.
NOW AT 75c
Money back if not satisfied. Send your order today.
WM. C. HOCKING CO., 499 Marine Bldg., Chicago, Ill.

USE GRINDSTONES?
If so we can supply you. All sizes mounted and unmounted, always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. *Send for catalogue "L."*
The CLEVELAND STONE CO.
6th Floor, Hickox Bldg., Cleveland, O.

Hayes Rubber Company
Largest exclusive dealers in Second-Hand Motor Cycles.
All makes in stock ready for immediate delivery. Write for special bargain rates. Machines bought, sold and exchanged.
Department "M," 57 Warren Street, New York City

PRINT for YOURSELF
Cards, circulars, book, newspaper. Press $5. Larger $18. Rotary $60. Save money. Print for others, big profit. All easy, rules sent. Write factory for press catalog, type, cards, paper. THE PRESS CO., Meriden, Conn.

FLYING MACHINES, LIVING AND LIFELESS.

(*Concluded from page 457.*)

birds are sustained and even lifted by wind blowing horizontally against the inclined under surface of their wings.

No bird can rise from the ground or even maintain a constant altitude in the air without moving its wings, unless the direction of the wind is more or less upward, as is often the case.

Sudden gusts, shifts of wind, and atmospheric eddies are great impediments to flight. Very few birds can struggle successfully against a tempest. The great soaring birds are less valiant in this respect than is commonly believed. The stormy petrel is so named, not because it braves the storm, but because it gives warning of a coming storm by taking refuge on the ship. The albatross skims the storm-tossed waves, but it often rests on them, sometimes swims, and, if need be, even sleeps on the water.

In fairly calm weather the equilibrium of birds in flight is maintained by a number of instinctive movements, which are perfectly adapted to the needs of the moment. The neck, as well as the tail, plays an important part in these maneuvers. Weiss and other experimenters have shown that the flight of a gull is made unsteady and even impossible by imprisoning the neck in a starched collar. Most insects appear to make great use of the abdomen in maintaining equilibrium. Wasps employ the abdomen in alighting and in turning.

As a general rule, birds, in alighting, check their horizontal motion by holding the body, and the extended neck, wings, and tail, nearly vertical, and insects effect the same result by bending the abdomen forward.

The sustaining surfaces of an aeroplane are analogous to the wings of a soaring bird, but while the bird propels itself indirectly by occasionally flapping its wings, rising and then gliding obliquely downward and forward, the aeroplane obtains its horizontal impulse from a screw propeller.

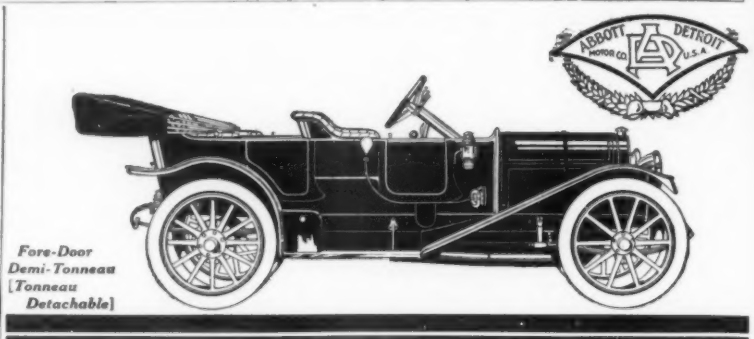
Some beetles which are sustained by their rigid elytra or wing-cases, and propelled by a helical movement of their posterior wings, present a closer analogy to the aeroplane, except in form, and even in this respect they have been imitated by Dr. Amans, who is constructing a flying machine of ovoid form, balanced and propelled by small wings. It has been proved by experiment that bumble bees and other hymenoptera can be deprived of their posterior wings, and butterflies robbed of much of their wing area, without losing the power of flight.—Adapted from "Lectures pour Tous."

The Future of Rubber in the Far East.

(*Continued from page 459.*)

Now this is the history of native coolie labor in the jungle in the Far East, and no doubt the same thing follows in Brazil as far as the wasteful gathering and destruction of trees is concerned. In Brazil the scarcity of labor is conceded to be the great drawback in procuring crude rubber; where efforts to import labor have so far been an absolute failure, thus leaving the shiftless Indians to be practically the only labor available. This scarcity of labor does not exist in French Indo-China, Siam, Malay Peninsula, Java, and Ceylon. Labor is plentiful. Under English law the English planter can get all of the Tamil coolies from India he needs, and he also has the great Chinese Empire to recruit from. In Siam alone nearly one hundred thousand Chinese coolies come in each year, and they are the agriculturists of the country, as well as the men who successfully work the great tin mines which supply the civilized world with tin. In Java the Dutch have thirty-five million Javanese coolies to draw on—an inexhaustible supply.

Knowing these facts, a parallel can be drawn between the future supply of rubber for the world and the present supply of cinchona bark from which quinine is obtained. The interesting history of cin-



Fore-Door Demi-Tonneau (Tonneau Detachable)

The $1500 Abbott-Detroit
In Many Respects Equals $4000 Cars

THE Abbott-Detroit is the one fully standardized motor car sold at $1500. It equals in many features and in its record many cars sold up to $4000.

Its painting and trimming specifications are parallel to those of any $4000 car on the market.

The Abbott-Detroit has Chrome Nickel Steel Construction in the transmission and rear axle with imported F. & S. Annular Bearings and Timken Roller Bearings.

The Abbott-Detroit has a complete electric light equipment of two electric head-lights and combination electric and oil side and rear lamps and Bosch High Tension or Splitdorf dual ignition system.

We Cannot Mention Here All The Features You Should Know About

If we had the space to point out to you how every part of the Abbott-Detroit has been brought to such a stage of perfection that we find it impossible to make any improvements, we could make you an Abbott-Detroit enthusiast.

We simply ask you, however, to consider this conclusive evidence of thoroughbred quality—that the Abbott-Detroit has never failed to place in a race or endurance run and has defeated some of the best cars built regardless of price.

Let Us Send You All The Vital Information You Need

The Catalog of the Abbott-Detroit will open your eyes to the fact that when you purchase the Abbott-Detroit, you will get more for your money than you ever expected to get in any motor car.

We can show you a purchase that will be one of the real satisfactions, the genuine values of your entire experience.

Just Sign Your Name And Address To The Coupon

Then tear it out and mail it. We'll send you the Abbott-Detroit Illustrated Catalog by return mail and prove to you that this is the car you want and must have just as soon as you realize what a wonderful car the Abbott-Detroit car is, especially at $1500.

And to Dealers wanting territory not already closed we'll be glad to make our regular Agency Proposition. Our production is limited and large contracts are closed. Prompt action is important.

PRICES—Model B, Five-Passenger Touring Car, Standard Equipment, $1500 F.O.B. Detroit. Roadster, Standard Equipment, $1500 F. O. B. Detroit. Fore-door Demi-Tonneau, (tonneau detachable). Standard Equipment, $1650 F.O.B. Detroit; Coupe, Standard Equipment, $2350 F.O.B. Detroit.

Abbott Motor Company
121 Waterloo Street Detroit, Michigan

"The Place for You to Sign"
Name_____
Address_____

Important & Instructive Articles on AVIATION

IN THE SCIENTIFIC AMERICAN SUPPLEMENT we have published in the past few years papers by some of the more eminent physicists and engineers on flying machines. No book thus far published is so complete and so authoritative as these articles. The range of the articles is wide, covering as it does the theoretical side of aviation as well as those more practical aspects which deal with the construction of machines. The following is a partial list of the more important articles which have appeared in the Scientific American Supplement; see special note below.

Nos. 1816, 1817, 1818, 1819, 1820, 1821 and 1822. **The Practice and Theory of Aviation.** By Grover Cleveland Loening, A. M. This is the most compact paper on aeroplanes that has probably ever been published. Fourteen biplanes and monoplanes are described in detail, and illustrated with scale drawings, namely, the Farman, Cody, Curtiss, Wright, Voisin (old model), Voisin (new model), and Sommer biplanes, and the Antoinette, Santos-Dumont, Bleriot XI, Bleriot XII, Grade, Pelterie and Pfitzner monoplanes. The proper dimensioning of aeroplane surfaces, as deduced by famous experimenters from their tests, is also considered. Taken as a whole this series of seven papers constitutes an admirable text book.

No. 1713. **The Wright Aeroplane.** This is a thorough description of the old type of Wright biplane with the horizontal elevation rudder in the front of the machine. Excellent diagrams and photographic views accompany the paper.

No. 1756. **Louis Blériot and His Aeroplanes.** Few people realize that Bleriot's successful monoplane is the result of ten years of daring and perilous experiment. In this paper will be found an instructive description of the evolution of the present successful Bleriot monoplane, illustrated with diagrams and photographs.

No. 1768. **The Farman Biplane.** A complete description of the Farman biplane, with detail drawings of the box tail and vertical rudders, the manner of working the four ailerons, hand and foot levers which control the machine, plan view and side elevation of the entire machine.

No. 1767. **The Santos-Dumont Monoplane.** An illustrated article describing the Demoiselle, the smallest and one of the fastest machines thus far made. Sketches accompany the article, showing the details of the construction and control.

No. 1582. **How to Make a Gliding Machine.** Full details and drawings which will enable anyone to make a glider for $15.00.

All these articles are profusely illustrated.

Each number of the Supplement costs 10 cents, mailed, and you can order as many of them as you wish. A set of papers containiug all the articles above mentioned will be mailed for $1.20.

Special Note.—**We will mail (gratis) a list of many additional important papers, in the Supplement, treating of aeronautics. Ask for list "A."**

ORDER FROM YOUR NEWSDEALER OR FROM

MUNN & COMPANY, Incorporated, PUBLISHERS
361 BROADWAY NEW YORK CITY

chona culture in the past century will be repeated in the history of rubber in this century. When that noble Spanish woman, the Marquesa de Chinchon, noble both by birth and nature, went among the sick beggars and prisoners in the jails in the city of Cadiz in Spain in 1562, giving those suffering from fever the red powder brought from Peru by returning Jesuit fathers and conquistadores, and which was said to be good for "heating of the blood and all humours," little did she think that the cinchona tree from which quinine is obtained would go down to posterity named after her, but so it is. *Cinchona rubra*, red cinchona; *Cinchona flava*, yellow cinchona.

This red bark soon achieved great repute in curing malarial fever, and later in the seventeenth century, both the Dutch and English governments sent expeditions to Brazil to procure specimens to be planted in their colonies in the East Indies. Out of twelve varieties containing different proportions of the alkaloid quinine, the scientists of the expedition picked out the two or three varieties which were the most valuable, and these were carried to the other side of the world and planted there. To-day the plantations of Ceylon and Java supply the chemists of the world with cinchona bark from which to extract quinine and its allied alkaloids, and Brazil has sunk to second place. There is as much cinchona bark in the Brazilian jungle as there was in times past, but it is not wanted in competition with the other, which has practically supplanted it.

This is exactly what will happen in the next few years to the rubber which comes from Brazil. To one who has not been in the Far East for the past ten years, the change is marvelous and wonderful. In Ceylon great areas of land are being planted with *Hevea Braziliensis*. Labor is plentiful and cheap. In Java the Dutch are energetically at work with their characteristic thoroughness, and are bringing great tracts of jungle and arable land into the active production of the great plantation of Para rubber—with labor unlimited. In the Federated Malay States, especially in Selangor, in Negri Sembilan, Perak, Pahang, and Johore, enormous areas of jungle as well as great coffee and tapioca plantations are being replanted with rubber. In Kedah, Kelantan, and Tringannu, the three Malay states just ceded by Siam to England, also, the work is being pursued with great energy by large companies, and Malay and Chinese labor is plentiful. In Siam, and in the peninsula, both Siamese and Europeans are going into the business by wholesale. The French in Cochin China are looking into the matter of rubber cultivation to offset the loss of revenue from the decreased amount of rubber gathered in the jungle, and are looking to the cultivation of Para rubber to do this. No place in the world is so favorable to the cultivation of Para rubber as is Ceylon, Java, and the west coast of the Malay Peninsula. Climate and conditions are ideal. In eight years or less trees are ready to tap, although the planters have to fight for what they get, as white ants and other enemies of rubber have to be combated with, as in other parts of the world.

It has been my lot to travel through the Federated Malay States, also in Siam from Burma to Indo-China, from west to east and from north to south, from within two hundred miles of the frontier of Yunnan in southern China to the Gulf of Siam, also across the frontier into Indo-China, in the course of a residence of five years in the Far East, so that I have had a wonderful opportunity to see what the jungle as well as the cultivated areas can do. This also applies to what I saw in Ceylon. On a recent journey of about twelve hundred miles, most of it made by horse and elephant, going to within a comparatively short distance of the southern Chinese frontier, I had the unique experience of discovering a tree which had never before been reported as yielding rubber. When about fifty miles to the westward of the Mekong River, near the town of Mok Dahan in northern Siam, we traveled for two days through a magnificent teak forest, which grew at an altitude of from three to four thousand feet, in the foothills of the Himalayas. After leaving this teak forest we had a rolling country, with the valleys showing characteristic tropical vegetation of bamboo and palm, and the higher ground showing mostly trees of hard wood such as rosewood and ebony, the country being very much open like an English park. Being compelled to ride an elephant on account of illness, as I could recline in the howdah, I had an opportunity to notice particularly the vegetation, as we traveled very slowly with a large expedition, there being eleven elephants to carry the sick, and about six hundred men, including officials and soldiers, with H. R. H. Prince Damrong, Minister of the Interior of Siam, at the head of the party. As we journeyed along, I noticed my mahout, who was walking beside the elephant, every now and then cut the branches of a certain tree which I had never seen before and feed the elephant with them; and while doing so, large quantities of a white juice ran from the cut ends. The elephants seem to be very fond of it. I procured some of the juice, and found it to be good rubber, and brought some of the branches and leaves home with me, carrying them for six hundred miles through the jungle. This tree the Laos people call Mai Chan. On arriving in the United States, I sent samples of the leaves and twigs to the Agricultural Department at Washington for classification. Secretary Wilson informed me that the botanical experts of the Department had decided the tree was *Ficus Rumphii*, and that it had never before been reported as yielding rubber; that many other trees of different species of Ficus also produced rubber.

About the same time a French traveler in Tonkin, French Indo-China, discovered a new rubber tree some hundreds of miles to the eastward of where I was. I believe it to be the same tree, and that we both stumbled upon the same fact. The tree is very similar in appearance to the Boh tree, the sacred tree of Buddhism. Of course the natives would not allow a Boh tree to be touched in any way. It is rather doubtful if this tree will be of much commercial importance.

In conclusion I would say again that the jungle will have to give way to the plantation and that the key to the situation will be labor unless as may happen, some genius may invent synthetically some substitute which will take the place of rubber. Stranger things have happened.

HANDCUFFS; AND ESCAPES THEREFROM.

(*Continued from page 460.*)

variation of this method is used, consisting in a small instrument, shown in Fig. 14. By placing the finger on the end of this device, and by turning the larger wheel with the thumb of the opposite hand, the plug, first of one cuff and then of the other, may be removed. After that, the "fake" is employed to unlock the cuff in the regular manner.

There are two varieties of "thumb cuff" in use—the old and the new. In both cases, the thumbs of the two hands are retained by this cuff, made just large enough to close over the thumbs. (Fig. 12.) The old style was fastened by means of a padlock, the release from which was by picking the lock. In the new style of thumb cuff, it is impossible to use the key when the cuffs are in position, consequently a "fake" similar to that used in the Bean giant cuff is employed—held between the teeth, inserted, and in that manner the release effected.

It would be useless to detail the actual methods of procedure necessary in order to open every style of cuff presented to the performer. It is simply a case of expert knowledge, dexterity, perseverance, and the possession of certain

"It's time you owned a Waltham"

What more appropriate, acceptable, and enduring gift than a watch? Waltham has been the watch favorite of social as well as of business and industrial life for nearly three-quarters of a century.

WALTHAM

has beauty to commend it, usefulness, reliability and integrity to make first impressions permanent. It is a watch that flatters the recipient and keeps the donor in constant and grateful recollection.

There is no more perfect specimen of watch making than the Waltham Colonial. Made as thin as it is safe to make a reliable time-piece, it is the last word in the watchmaker's art. At all JEWELERS, from $50 to $175. Write for handsome booklet, describing the various Waltham movements and learn the one best suited to your needs.

WALTHAM WATCH COMPANY, - WALTHAM, MASS.

$5.00 Electrical Experimental Outfit for the Boys Christmas $5.00

Complete outfit includes 5-pound generator, will excite coils, ring bells and light lamps. Has bronze bearings, brass 4 inch gear drive, silk-wound armature and is furnished with the following material and instruments:

Ten assorted fittings as sockets, lamps, plugs, fuses, &c. Six blue prints of 50 simple electrical diagrams. Complete signal outfit to assemble (24 pieces) wire, fibre, brass tubing, tape, ball, &c. Three electro-magnets, 20, 50, 100 Ohms, solenoid, three 1-pound permanent magnets, compass, iron filings and telephone induction coil. Three stamped envelopes addressed to our instructor.

FREE COUPON. Send in this coupon with your order of $5.00 and we will send you FREE, one 250 page electrical book and for $1.00 extra, a complete telephone worth $5.50 with receiver, transmitter, cradle, induction coil and ringers. S. A.

WESTERN ELECTRIC SALVAGE COMPANY

1224 So. Washtenaur Ave., Chicago, Ill.

Wizard Mono-Rail Jumping Top!

Wizard Encased Tight-Wire JUMPING TOP, Postpaid, $1.00

Finest top made. Spins 12 minutes with one turn of cord. Walks tight wire. Jumps from wooden egg while spinning. All running parts are inside polished steel case. Postpaid $1. Both Jumping tops, $1.40.

"Zola" Fortune Telling top, 25c., Postage 5c. extra.

"Vari-Scope," chromatic game top, just out, $1.50 prepaid.

Performs fifty startling tricks. Six for 40c. prepaid.

A Barrel of Fun for only 50c.

Demonstrations at department stores, or mailed for 50c., $5 doz. Exp. Paid. Endlessly amusing and instructive. Travels 100 ft. on inclined wire. Jumps from wooden shell while spinning. Baffling Mystery. Order now.

W. P. D. Co. Dept. 28 129 W. 31st St., N.Y.

Rides 100 ft. on inclined wire while spinning.

STYLE A

50c. post paid

New 1910 Edition Just Published

VEHICLES OF THE AIR

By V. LOUGHEED

A Popular Exposition of Modern Aeronautics with Working Drawings. The most complete book published on aerial navigation. 314 pages, 6½ x 9½ inches, 270 illustrations, including working drawings of machines and parts. Price $2.75 postpaid. Send for a descriptive circular.

MUNN & COMPANY, Inc., 361 Broadway, New York City

TRY THE SMITH FREE

We want a SMITH STUMP PULLER on every stump or timbered farm in the country. It has a cost record of 5¢ a stump where the stumps run from 1 to 3 feet through; it will clear from 1 to 3 acres a day, doing the work of 20 men. Write today for our catalogue and FREE TRIAL OFFER.

W. SMITH GRUBBER CO., 15 Smith Sts. La Crescent, Minn.

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 10 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. **In every case it is necessary to give the number of the inquiry.** Where manufacturers do not respond promptly the inquiry may be repeated.

MUNN & CO., Inc.

BUSINESS OPPORTUNITIES.

Inquiry No. 9173.—Wanted, manufacturers of machinery for removing fibre (coir) from cocoanut husks.

$2,000.00—WE WILL LEND YOU $2,000 UNDER certain reasonable conditions, and agree that you may repay the loan from the dividends on an investment which we will suggest. For full information, address Continental Commercial Co., St. Louis, Mo.

Inquiry No. 9175.—Wanted, manufacturers of a machine called Benasco or Biasco, used in the manufacture of ostrich feathers.

PATENTS FOR SALE.

COMBINATION window shade and lace curtain hanger; no nails or screws in casing; attached in one minute. A winner. Will sell on royalty or outright. J. N. Farrahn, 311 S. Main, Wichita, Kans.

Inquiry No. 9188.—Wanted, manufacturers of rubber block tires for one ton trucks.

FOR SALE OR ROYALTY.—Patent No. 968,769 an improved electric center grinding machine. For further information address William A. Ireland, 47 Johnston Street, Newburgh, N. Y.

Inquiry No. 9190.—Wanted, name and address of parties who make for sale pattern letter moulding machines and matrix.

FOR SALE.—Patent No. 968,677. Pneumatic pad for horse collars, issued August 30th, 1910. Patents applied for in Canada and Mexico. For particulars address W. Stillman, Springfield, S. D.

Inquiry No. 9202.—Wanted, to buy the Rose fountain pen.

PROFITABLE OPPORTUNITY.—For sale, patent of self-balancing Ship-Table—keeps an "even keel" regardless of ship's motion. Universally needed. Vast profits. A. M. Gustafson, Box 781, Bisbee, Arizona.

Inquiry No. 9203.—Wanted addresses of those who can offer tourmaline crystals in quantity.

FOR SALE.—Patent No. 888,053. Propeller for vessels, ships, and air craft. Will produce greater efficiency and speed with less fuel consumption than screw propeller and is worth half a million. To be sold for $2,500. For particulars address August Ahlbrecht, 810 River Ave., East End, Pittsburg, Pa.

Inquiry No. 9204.—Wanted, to buy non-binding necktie holder.

HELP WANTED.

FOREMAN.—A good position in the country for the right man. Must now be holding a responsible position in manufacturing business. Must be under 35 years of age. Give full references as to habits, character and ability. Also state present salary. Applications confidential. Address Position, Box 773, New York.

Inquiry No. 9205.—Wanted, to buy nicotine consumer fitting any pape.

GET A BETTER PLACE—Uncle Sam is best employer; pay is high and sure; hours short; places permanent; promotions regular; vacations with pay; thousands of vacancies every month; all kinds of pleasant work everywhere; no lay-offs; no pull needed; common education sufficient. Ask for free Booklet 83, giving full particulars and explaining my offer of position or money back. Earl Hopkins, Washington, D. C.

Inquiry No. 9206.—Wanted, manufacturers to sell castings such as hammers in the rough.

SITUATIONS WANTED.

Inquiry No. 9207.—Wanted, names and addresses of firms making star section iron and steel suitable for lightning rods.

PURCHASING AGENT.—Young man (36) with eleven years' practical experience in buying for a large manufacturing concern, desires position as purchasing agent. Address Experience, Box 774, New York.

Inquiry No. 9208.—Wanted, the address of the manufacturer of the "Little Giant" Pump.

WANTED.

Inquiry No. 9209.—Wanted, names of owners of gold placer properties.

MEN seeking a future wanted in every town, absolutely the best and most appealing proposition ever offered. This is no scheme or specialty proposition. Investigate. Metallic Mfg. Co., 745-747 E. 9th St., Chicago, Ill.

Inquiry No. 9210.—Wanted, names of owners of deposits of pumice or volcanic ash.

PATENT specification writer, first-class, wanted for permanent position in N. Y. City. Address stating particulars and salary desired. Specification, Box 773, N. Y.

LISTS OF MANUFACTURERS.

COMPLETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lists compiled to order at various prices. Estimates should be obtained in advance. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9211.—Wanted, addresses of parties who can ship ore containing, vanadium, molybdenum, or bismuth.

SALE AND EXCHANGE.

A LIST OF 1,500 mining and consulting engineers on cards. A very valuable list for circularizing, etc. Price $15.00. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9212.—Wanted, names and addresses of owners of fluor spar properties.

Inquiry No. 9213.—Wanted, addresses of parties making Viscol compound for shoes or shoes made from leather treated therewith.

Inquiry No. 9214.—Wanted, address of maker of "Piako," a fastening for ladies' dresses.

Inquiry No. 9215.—Wanted, machine for producing a good finish on hammer and other handles.

Inquiry No. 9216.—Wanted, to buy a sewing machine having a very long arm for special work.

Inquiry No. 9217.—Wanted, the names and addresses of manufacturers of machinery for shelling almonds and peanuts.

Inquiry No. 9218.—Wanted, the names and addresses of manufacturers of outfits for salting almonds and peanuts.

Inquiry No. 9219.—Wanted, names and addresses of manufacturers of bags, cartons, and oiled and waxed paper for marketing salted almonds and peanuts.

Inquiry No. 9220.—Wanted, the names and addresses of manufacturers of plants for the preparation and mixing of baking powders; also dealers in ingredients for making the powder, manufacturers of cans, labels, etc., for packing baking powder for the market.

Inquiry No. 9221.—Wanted, names and addresses of owners of mica properties.

Inquiry No. 9222.—Wanted, names and addresses of owners of white silica sand deposits.

Inquiry No. 9223.—Wanted, to buy machinery for making sugar of milk.

Inquiry No. 9224.—Wanted, to buy a motor driven floor scrubbing machine.

Inquiry No. 9225.—Wanted, a concern able to grind and polish hammers.

Inquiry No. 9226.—Wanted, to buy a machine for making flat sided popcorn cakes.

Inquiry No. 9227.—Wanted, a power-driven saw for cutting down pine trees twenty inches in diameter.

Inquiry No. 9228.—Wanted, to buy fabric tufting machines.

"fakes," "skeleton," and "master" keys, and other instruments which the performer selects and employs in each case, having to depend largely upon his resourcefulness to effect his release.

There is no "royal road" to becoming a handcuff expert, and constant work and a close study of lock picking, of the makes and construction of the various locks, handcuffs, leg irons, etc., is essential. One or two apparently sensational performances will greatly add to the expert's reputation, though they may be comparatively easy in themselves. One such is the escape of the performer from handcuffs so fastened upon him that his right wrist is drawn back over his shoulder, and his left wrist up behind his back. (Fig. 6.) In this position he is apparently helpless.

As soon as the performer goes into his cabinet, however, he pulls upon the right arm and, by means of tugging and a certain strain upon the left arm, succeeds in bringing it forward over his head, so that the hands are now in front of him. In this position, they may be opened in the usual manner.

It need hardly be said that the famous prison cell escape of which so much capital has been made, resolves itself merely into a lock-picking contest. If the performer can succeed in picking the lock by means of skeleton keys, "fakes," etc., he is enabled to escape; if not, he fails. The success of the experiment depends partly on the ability to conceal the various "fakes" or keys employed so that they will not be found when he is searched, and partly upon the dramatic presentation of the trick. Of itself it is not more remarkable than any other lock-picking experiment, though it appears to be so.

A LOCOMOTIVE STAGE.

(*Continued from page 461.*)

spuds alone, in virtue of the connection of the outer and inner frames by means of the rolling frame and the 8 pairs of rollers.

The rollers are 18 inches in diameter and 6 inches wide. They turn on fixed axles, 3 inches in diameter, by means of friction rollers, 1 inch in diameter.

The first Piercy locomotive stage ever constructed accomplished in the deepening of the Peterhead fishing harbor, a task that had been pronounced impossible. It saved three years, $35,000 and a heavy penalty by blasting and removing 8,500 cubic yards of solid granite rock under water in eight months at a cost of about $20,000. The cost of the stage and equipment, except the boring plant, was about $3,000. Previously eighteen months and $15,000 had been spent on the removal of about 1,500 cubic yards of rock.

Locomotive stages, designed in accordance with the special character of the work, can be employed with advantage in practically all operations in and under water shallow enough to permit the use of staging of any sort, and also on land in certain cases. In considering these applications it should be noted that a locomotive stage can be provided with floats or pontoons for quick transport and that an all-timber stage, with its spuds raised, can be floated like a raft to its work.

Any sort of dredging or excavating machinery can be mounted on a locomotive stage, and would be superior to a floating dredge in swift tidal or other currents, in exposed positions at sea, or in rivers and harbors where mooring cables interfere with traffic.

For submarine boring and blasting a properly equipped locomotive stage presents the great advantages of independence of tidal rise and fall and safety, without removal, during blasting. For

A 2-Foot Model Aeroplane $1

A study for the man, a source of delight for the boy. With an ironclad guarantee to satisfy or money refunded we are mailing postpaid a complete working model of the Bleriot, Demoiselle, Wright, Santos Dumont and Antoinette Aeroplanes.

These Aeroplanes are exact duplicates of the above famous machines AND WILL FLY. Price $1.00.

Curtiss and Farman Models under same guarantee, price $2.00. Aviation is still in the experimental stage. Using our Model for observation and study will help you to perfect or improve aerial navigation.

AMERICAN AEROPLANE COMPANY, Singer Building, New York City

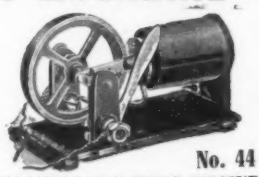
AN IDEAL CHRISTMAS PRESENT FOR FATHER, SON OR BROTHER

Your Choice of these Three Premiums with One Year's Subscription to *POPULAR ELECTRICITY MAGAZINE* For $1

1-2 SIZE

No. 55 MAGAZINE POCKET SCREW DRIVER

The need and usefulness of this tool will be instantly recognized. There is nothing just like it or that can be compared with it in the market today. It is made with four detachable blades of varying widths and thicknesses to suit different size screws. The blades are kept in magazine formed by handle. The tool is small and convenient to carry in the pocket, measuring when closed only 3 inches long and .58 inch in diameter, and weighing only two ounces.



No. 44 PERFECT ELECTRIC ENGINE

This attractive electric engine, three times size shown in illustration, built on scientific principles. Runs 1,000 revolutions a minute on one dry battery. Has a speed control and reversing lever. Amusing and instructive for you and your friends.

No. 99 Screw Driver Knife

Twice size illustrated.

Combines all purposes of screw driver and pocket knife. Handsome hardwood handle; well tempered, keen edge blade, strong enough to cut wire; screw driver end. Closes like pocket knife locks when open. Can not shut down on the hand while in use. A very handy and useful tool for all purposes.

Why Don't You Read Up On Electricity?

Haven't you often thought, "I must read up on electricity; I'm ashamed not to know what's **watt."** Thousands are saying that, and it's for them and you **POPULAR ELECTRICITY** is published. A high-class monthly magazine, plumb full of interest to **everybody.** Not a bit technical—yet all electrical men want it—but written in Plain English, delightfully entertaining and instructive, with 100 illustrations each issue. Keeps you posted on all electrical events. Shows how to perform interesting experiments, make and use electrical devices. "wireless" apparatus, etc. Full of hints on business economy and efficiency. Helps and interests the ladies. **Junior Section** delights the boys. Gives yours a chance. He may be a future Edison. **Wireless Club Membership Free to Readers;** electrical questions answered free, with many other privileges. Special offer, $1.00 a year (Canada $1.35, foreign $1.50), including **the premium you select.**

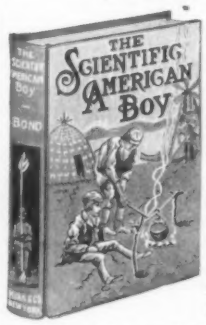
POPULAR ELECTRICITY MAGAZINE, 440 Commercial Building, CHICAGO

Holiday Suggestions in Useful Books

TWO INTERESTING AND INSTRUCTIVE BOOKS FOR BOYS

The Scientific American Boy

By A. RUSSELL BOND

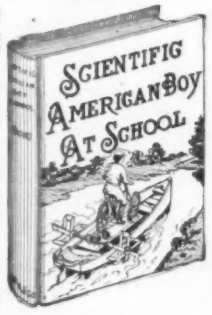


This is a story of outdoor boy life, suggesting a large number of diversions, which aside from affording entertainment, will stimulate in boys the creative spirit. In each instance complete practical instructions are given for building the various devices.

12 mo. 320 pages 340 illustrations Price $2 postpaid.

The Scientific American Boy at School

By A. RUSSELL BOND



This is a sequel to "The Scientific American Boy" and like its predecessor is brim full of practical suggestions. It is also written in story form which makes it interesting as well as instructive to the boy. The ideas are all entirely new.

12 mo. 338 pages 314 illustrations. Price $2 postpaid

No boy with a mechanical turn of mind can read these books without being inspired to try his own hand at making the devices

MAGIC, Stage Illusions and Scientific Diversions, Including Trick Photography

Compiled and Edited by ALBERT A. HOPKINS

The work appeals to old and young alike, and is a most attractive holiday book. The illusions are illustrated by the highest class of engravings, and the exposes of the tricks are, in many cases, furnished by the prestidigitateurs themselves. Conjuring, large stage illusions, fire-eating, sword-swallowing, ventriloquism, mental magic, ancient magic, automata, curious toys, stage effects,

photographic tricks, and the projection of moving photographs, are all well described and illustrated, making a handsome volume. It is tastefully printed and bound. Acknowledged by the profession to be the standard work on magic.

Octavo (7x10 inches), 556 pages, over 400 illustrations.

Price $2.50 postpaid.

MUNN & CO., Incorporated, Publishers, 361 Broadway, New York

BUY THE LOWEST COST ENGINE

MADE. Lowest fuel cost; lowest up-keep cost; easiest on the machine it operates, delivering steadier power than any other gasoline engine, adapting it especially for operating farm machinery, with better results and least waste of grain. Lowest fuel cost for it runs on Gasoline, Kerosene, Distillate, Gas or Alcohol and has perfect lubrication. Lowest cost because it delivers greatest available power per horse. A slow speed, high duty engine. Starts easier and quicker than any other engine, occupies less space, is less cumbersome, with less vibration, therefore adapting it for either stationary, portable or traction use. **IT IS THE POWER CONTRACTOR'S FAVORITE ENGINE.** No engine made has so wide a range of use. **YOU WILL MAKE A MISTAKE IF YOU DO NOT WRITE US FOR INFORMATION.** 1½ H. P. to 5½ H. P. single cylinder. **6 to 20** H. P. two cylinder. 30 to 50 H. P. four cylinder. State your requirements and get our advise, **THE TEMPLE PUMP CO., Manufacturers, 417 West 15th St., Chicago, U. S. A.** This is our 58th year.

This Large FREE Catalog

Tells You How to Get Twice As Many Magazines For the Same Money

A list of 3000 magazines, newspapers and clubbing offers—Unique in the subscription field because it offers almost every possible combination desired.

It is crowded with profitable-to-you-suggestions. You cannot afford to be without it.

J. M. Hanson's is the largest magazine subscription agency in the world—known everywhere.

Absolutely reliable and the most prompt in the magazine field.

Save Magazine Money

If your magazine money is limited—if you want to take more magazines, newspapers, periodicals of any or every class you can do so without increasing your present expenditure.

Our long time contracts direct with publishers insure you this. Write to-day for our 1911 catalog—if you want to save on magazine money or increase your list with no greater expenditure.

Send for this FREE Catalog

☛ A postal with your name and address will do.

J. M. HANSON'S MAGAZINE AGENCY

240 HANSON BLOCK

LEXINGTON, KENTUCKY

these and other reasons it greatly diminishes the time and cost of the work and will probably make possible operations, the cost of which has hitherto been prohibitive.

The locomotive stage also affords an ideal support for rock-breaking machines and for diving bells.

The work of driving piles would in many cases be considerably cheapened and hastened by the use of a locomotive stage, which is greatly superior to a floating barge in rigidity, ease and accuracy of adjustment, and independence of currents, tides, waves, anchors and cables, and also offers advantages over cantilever or overhanging pile drivers resting on the completed portion of the work.

The construction of breakwaters in deep water and exposed positions is one of the most important uses of the locomotive stage, which entirely eliminates the construction of falsework and the attendant difficulties of driving piles and bracing under water in dangerous situations. A stage, carrying a crane capable of lifting 15-ton blocks off the finished work and setting them anywhere within a distance of 100 feet, would cost less than one-third the price of a "Titan," running on the finished work.

Similar remarks apply to the construction of outlying lighthouses and other works. In constructing caissons or other foundations in which the permanent work consists largely of staging, this staging could be made locomotive, built on shore, walked out to the site and, after it had served its purpose as staging, the spuds could be driven down to form piles of the permanent work.

For salvage and wreck raising, wherever the water is not too deep the locomotive stage offers the great advantage that it can work in rough weather, in which the wreck might soon break up and become a total loss. The stage would be floated or barged to a point near the wreck, and would then raise itself on its spuds, and walk to the wreck.

On land, when some heavy plant must be moved along the work over boggy, rocky or very uneven ground on which tracks cannot be laid, the plant could be mounted on a locomotive stage, having spuds of suitable length.

Light locomotive stages could be employed as temporary piers for landing troops and baggage. They would be connected with the shore by gangways, which would be constructed as the stage walked out.

Locomotive stages would also form cheap and convenient piers for seashore resorts. At the end of the season they could walk ashore and thus escape the fury of winter storms.

Aerial navigation has had its fasination from the earliest times. John, Lord Bishop of Chester, was skilled in mechanics as well as in theology, and speculated upon conveying men bodily to other worlds. In a tract on the "Discovery of a New World in the Moon," London, 1638, he suggests three modes of conveyance. The first is to fit wings to the body of a man; the second is to teach a large bird to carry a man, so he can ride "as Ganymede did upon an eagle"; and the third is plainly a "heavier than air" airship. In describing the latter, the good Bishop says; "I do seriously and upon good ground affirm it possible to make a *flying chariot* in which a man may sit and give such motion unto it as shall convey him through the air; and this perhaps might be made large enough to carry divers men at the same time, together with food for their viaticum and commodities for traffic." He also naively suggested that the construction of such a chariot was "no difficult matter, if a man had leisure to show more particularly the means of composing it." It will always be a source of regret that the prophetic Bishop could not have spared the time "to show the means of composing" the interesting subject of his imagination.

THE "BEST" LIGHT

More brilliant than electricity or acetylene and cheaper than kerosene. Costs two cents per week. Casts no shadow. Most perfect light for stores, factories, churches, public halls or the home. Makes and burns its own gas. Simple, durable and handsome. In use in every civilized country in the world. No dirt. No grease. No odor. Over two hundred different styles. Agents wanted everywhere. Write for catalog and prices.

THE BEST LIGHT CO.
87 E. 5th St., Canton, O.

ANTI-NICOTINE PIPE

"Get the Pleasure Without the Poison" Trade Mark Reg.
The Pipe They Let You Smoke At Home
Looks and colors like meerschaum. Absorbs the nicotine and keeps on tasting sweet. You never had such an enjoyable smoke.
Order 3 or More Today.
H. MENGES
The Smoker's Friend
104 N. 7th St., St. Louis, Mo.

40¢ Three For $1.00
Sent Prepaid Anywhere
Money Back if Not Satisfactory

ICE MACHINES Corliss Engines, Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton St., Milwaukee, Wis.

MODELS & EXPERIMENTAL WORK, Inventions developed. Special Machinery. E. V. BAILLARD CO., 24 Frankfort Street, New York.

SOUTHERN STAMPING & MFG. CO.
Manufacturers of special and patented articles.
R. S., Nashville, Tenn.

DRAWING MATERIALS
F. G. RUEHLE & CO., Manufacturers
119 Fulton Street, New York, U. S. A.
We Do Repairing of all kinds of Instruments

RUBBER Expert Manufacturers Fine Jobbing Work
PARKER, STEARNS & CO., 286-290 Sheffield Av., B'klyn, N.Y.

BABBITT METALS.—SIX IMPORTANT formulas. SCIENTIFIC AMERICAN SUPPLEMENT 1123. Price 10 cents. For sale by Munn & Co., Inc., and all newsdealers. Send for catalogue.

INVENTORS Let us build your model before you apply for a patent. Advice free.
G. Schwarz & Co., 123 Liberty St., New York

M. P. SCHELL MFG. CO., Manufacturers of Special Machinery, Patented Devices, Metal Articles, Tools and Dies. Gear Cutting, Punching Work. Models and Experimental Work. 509-511 Howard Street, San Francisco, Cal.

Experimental & Model Work
Cir. & advice free. Wm. Gardam & Son, 231 Fulton St., NY

THE SCHWERDTLE STAMP CO. STEEL STAMPS, LETTERS & FIGURES BRIDGEPORT CONN

THE SOLUTION OF THE WOOD PRESERVING PROBLEM

INDIAN TIMBERASPHALT

makes it possible to treat timber thoroughly and effectively *at low cost.*

"TIMBERASPHALT" costs ½ as much as Creosote, and ⅛ as much as other Coal Tar preparations. It is slower-running and not susceptible to weather changes. It excludes moisture, heat and air, thereby preventing the attack of wood destroying fungi. This insures the maximum life of the timber under all conditions.

It may be applied by Brush, Open Tank or Pressure Methods. Write today for detailed information and prices.

THE WOOD PRESERVING DEPARTMENT
INDIAN REFINING CO., Inc.
General Offices:
307 First National Bank Building
Cincinnati, Ohio

INDIAN TIMBERASPHALT

Preserves
Flooring
Piling
Paving Blocks
Cross Arms
Bridge Timber
Shingles

Preserves
Railroad Ties
Telephone Poles
Fence Posts
Mine Timber and
Structural Timber
of every description

Learn Watchmaking
We teach it thoroughly in as many months as it formerly took years. Does away with tedious apprenticeship. Money earned while studying. Positions secured. Easy terms. Send for catalog.
ST. LOUIS WATCHMAKING SCHOOL, St. Louis, Mo.

LEARN TELEGRAPHY

MORSE and WIRELESS at home with OMNIGRAPH AUTOMATIC TEACHER in half usual time—trifling cost. Sends you messages without limit automatically—easily learn expert. Price $2.00. Catalog free. OMNIGRAPH MFG. CO. Dept. 16, 39 Cortlandt Street, New York.

Magical Apparatus.
Grand Book Catalogue. Over 700 engravings
25c. Parlor Tricks Catalogue, free.
MARTINKA & CO., Mfrs., 493 Sixth Ave., New York

MASON'S NEW PAT. WHIP HOISTS
save expense and liability incident to Elevators.
Adopted by principal storehouses in New York & Boston
Manfd. by VOLNEY W. MASON & CO., Inc.
Providence, R. I., U. S. A.

MODELS CHICAGO MODEL WORKS

American Homes and Gardens

CONTENTS FOR DECEMBER, 1910

PUBLISHED MONTHLY BY MUNN & CO., INC.
361 BROADWAY NEW YORK CITY
PRICE 25 CENTS

"My Xmas present; say, but these are fine"

COOPER'S
REG. U. S. PAT. OFF.

SPRING NEEDLE KNIT
UNDERWEAR

is without a peer in the Underwear world. It is original, exclusive, distinctively grade de luxe. The famous Spring Needle fabric is knitted on machines invented, patented (in nine countries) owned and controlled by the Company. Wear the genuine Cooper's and you will experience absolute next-to-the-skin comfort. Write to us for generous sample of fabric and illustrated booklet showing styles and prices.

COOPER MFG. CO.
34 Main Street, Bennington, Vt.

Manufacturers of a famous "Gauzrib" Spring Needle fabric for Women's wear. Tell your wife.

Boston Garter

Velvet Grip

The Boston Garter grasps the leg and your half hose in a way that feels good and safe.

See that BOSTON GARTER is stamped on the clasp.

WORN THE WORLD OVER BY WELL DRESSED MEN.

Sample Pair, Cotton, 25c., Silk, 50c.
Mailed on Receipt of Price.

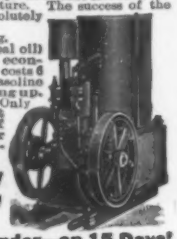
GEORGE FROST CO. MAKERS
BOSTON, MASS., U.S.A.

Its Economy and Power Startle the World!

The Engine Runs on COAL OIL at a Fraction of Cost of Gasoline.

Thousands of these marvelous engines—in actual use—prove beyond question that kerosene is the coming fuel of the future. The success of the "Detroit" Engine is absolutely unparalleled.

Demand is overwhelming. Kerosene or common coal oil runs it with wonderful economy. Kerosene generally costs 6 to 8 cents per gallon less than gasoline—and gasoline is still going up. Runs on any engine fuel. Only three moving parts. Light and portable. Does work of engines weighing four times as much. Runs everything.



The Amazing
"DETROIT"

The Kerosene Wonder—on 15 Days' Trial—Direct From Factory

Any engine you want, from 2 to 20 H. P., sent on 15 days' free trial—tested immediately before shipping and ready to run. If dissatisfied—every dollar you have paid us for the engine cheerfully refunded. Prices lowest ever known for high-grade, guaranteed engines.

The New Book is Ready—WRITE! Tells all about these new wonders that mark a newera in engines. Special introductory price on first "Detroit" engine sold in each community. Quick action gets it. Address

Detroit Engine Works, 127 Bellevue Ave., Detroit, Mich.

Incorporate Your PATENTS and BUSINESS in ARIZONA

Laws the most liberal. Expense the least. Hold meetings, transact business anywhere. Blanks, By-Laws and forms for making stock full-paid for cash, property or services, free. President Stoddard, FORMER SECRETARY OF ARIZONA, resident agent for many thousand companies. References: Any bank in Arizona

STODDARD INCORPORATING COMPANY, Box 8009
PHOENIX, ARIZONA

CRUDE ASBESTOS
DIRECT FROM MINES

PREPARED ASBESTOS FIBRE for Manufacturers use

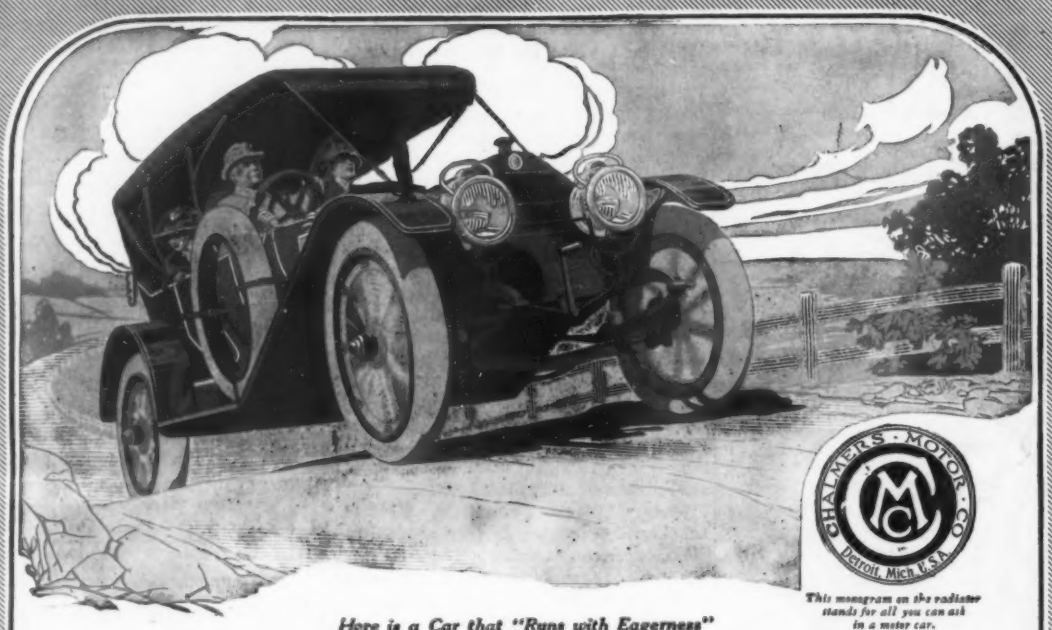
R. H. MARTIN,
OFFICE, ST. PAUL BUILDING
220 B'way, New York.

YOUR SAFETY RAZOR BLADES

Can be resharpened hundreds of times and made better than new with a Gaylor Stropper. Price $1.00. State make. Circular free.

Gaylor Automatic Stropper Co., Stamford, Conn.

HELMET OIL LUBRICATES ANYTHING SEND FOR SAMPLE FREE
118-124 North Clinton St.
C. H. BESLY & CO. CHICAGO, U.S.A.



Here is a Car that "Runs with Eagerness"

This monogram on the radiator stands for all you can ask in a motor car.

Always at Your Service

A good motor car asks no favors of the weather. The day has passed when owners of automobiles pack their cars in moth balls with the first descent of Jack Frost.

With the arrival of the bracing cold and snowy days, ninety-two per cent. of Chalmers owners put on windshields, tops, chains, gloves, warm coats and robes, and—"go to it." It's great.

With top and side curtains, warm robes and a "hot iron," any car is comfortable all winter long for all members of the family. People don't "wait till spring" any more to buy cars. An automobile is a twelve-month proposition, and as serviceable in saving time in one season as another.

In fact, in winter, when street cars are so often tied up, when they are always crowded and filled with bad air, is when many city dwellers appreciate their cars the most.

Who's afraid of a ride in the stinging winter air? Or who's afraid of a little battle with a snowstorm? Modern men are not mollycoddles because they refuse to wear iron clothes and carry a sword, and because they insist on a bath every day. A drive to business with the thermometer below freezing is the sort of experience that makes you feel like whipping the stuffing out of your day's work and taking a fall out of your biggest problems.

The wisest buyers purchase cars in the fall and winter. Then they are ready for use when the warm days come to tantalize you into the country.

Figure out what the interest would be on the price of a car between now and next spring. Only the price of a good dinner. What is that compared to the service the car could render you in the meantime?

Besides, if you order now you are sure of having your car when you want it the most. There is always a time in the spring when everyone wants cars all at once. And many are always disappointed.

Leaving our own interests out of the question, we want to tell you frankly that if you are going to buy a 1911 car at all, now is the best time to place your order.

So far as Chalmers cars are concerned, they are built on a quality, not a quantity basis. A good many people who wanted Chalmers cars last year were disappointed, because they waited too long to place their orders. Our dealers are ready to show you the new models at your convenience. Catalogue R on request.

"It Runs with Eagerness"

That is what the owner of a Chalmers "Forty" said recently, describing his car.

A telling phrase, that! It describes better than any we ever heard the peculiar charm of a "Forty." We could talk to you by the hour, giving you the statistics of this car, the cold, reason-why facts of it—bore and stroke, wheel base, frame dimensions, length of springs and all that. And in all these things this car is the equal of any made.

And yet that wouldn't give you an adequate idea of just what this car is. Beyond the design, the steel, iron, wood and rubber, there is still a great something in this car which dimensions and materials cannot account for—an intimate, human quality. "It runs with eagerness."

People are all made of exactly the same materials. In general features they are all alike. Yet some are "different." There is about some a something you can't explain by external terms—a personality, a superiority which rises from within, from reasons unexplained.

A Chalmers "Forty" among automobiles has that rare quality. A quality of youth and life and unflagging energy. "It runs with eagerness."

A great many very particular people agree that there is no more beautiful car, either in line or finish than the Chalmers "Forty."

The price of $2750 includes Bosch magneto, Prest-O-Lite tank and gas lamps.

If you want high power, maximum seating capacity and some of the final words in lines and finish, then you really should see this car.

Any Good Car a Good Investment

There are many good cars made nowadays, and any good car is a good investment. Yet we honestly believe that Chalmers Cars offer the best value for the money of any on the market. Compare them with others. Comparison has sold more Chalmers Cars than all our advertising. If you can possibly afford a motor car, don't put it off any longer but go and buy one. We hope it will be a Chalmers; but whether it is or not, don't deprive yourself and your family any longer of the pleasure that by right is yours and theirs. There is nothing that you could invest the money in that will pay you such a big dividend in the saving of your time in business and the saving of your health for years, as the purchase of a motor car. A good thing is a better thing the sooner you get it. Make your family happy to-night by telling them that you have made up your mind to get that motor car you have been talking so much about, namely,—a Chalmers

Chalmers Motor Company Detroit, Michigan

(Licensed under Selden Patent)